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WAR MACHINE

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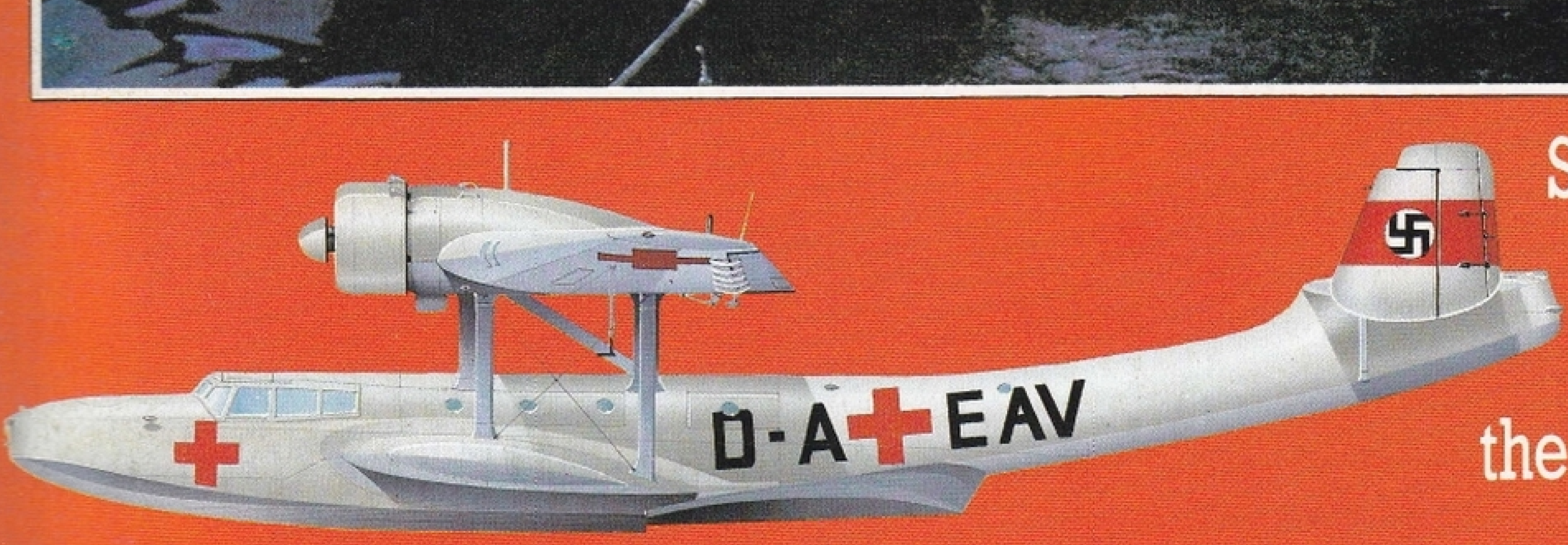
Armed Forces of the World: US Navy (Part 6)

Flying-boats in the Pacific War



Sunderland in Action

Flying-boats in the Battle of the Atlantic

A fully illustrated guide to Flying-boats of World War II

WAR MACHINE

Volume 4 **Issue 39**

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Armed Forces of the World

US Navy (Part 6) iii

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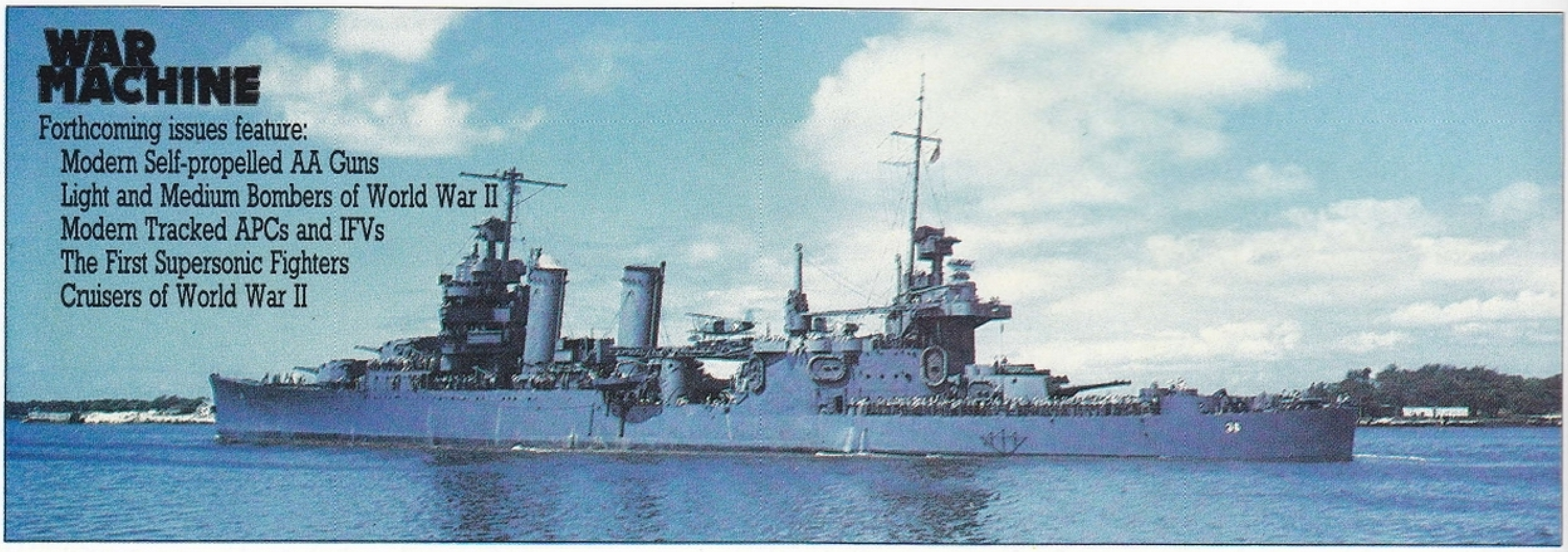

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Cruisers of World War II

Flying-boats of World War 11

During the early years of World War II, flying-boats were of crucial importance in allowing long-range maritime patrols. However, with the introduction of very long-range land-based aircraft, which had greater flexibility and which could operate from ordinary airfields, the flying-boats gradually faded from the scene.

Seen flying over the Greek islands late in 1940, this Sunderland served on No. 230 Sqn which, with No. 228 (also with Sunderlands) took part in the evacuation of Greece and Crete the following year.

If glamour ever attached to fighting men there was little but monotony in the work of the flying-boat crews of World War II. Few nations had paid heed to this class of military aeroplane in the years of peace beforehand, with the result that when war came recourse was widely made to the adaptation of ageing commercial aircraft, and none of the belligerent powers produced a wholly new design from concept during the war years in time to reach production and service. As might be expected from the maritime nations, the USA, the UK and Japan possessed the most consistently successful aircraft from the outset, the Consolidated PBY Catalina, the Short Sunderland and the Kawasaki H8K 'Emily' boats respectively.

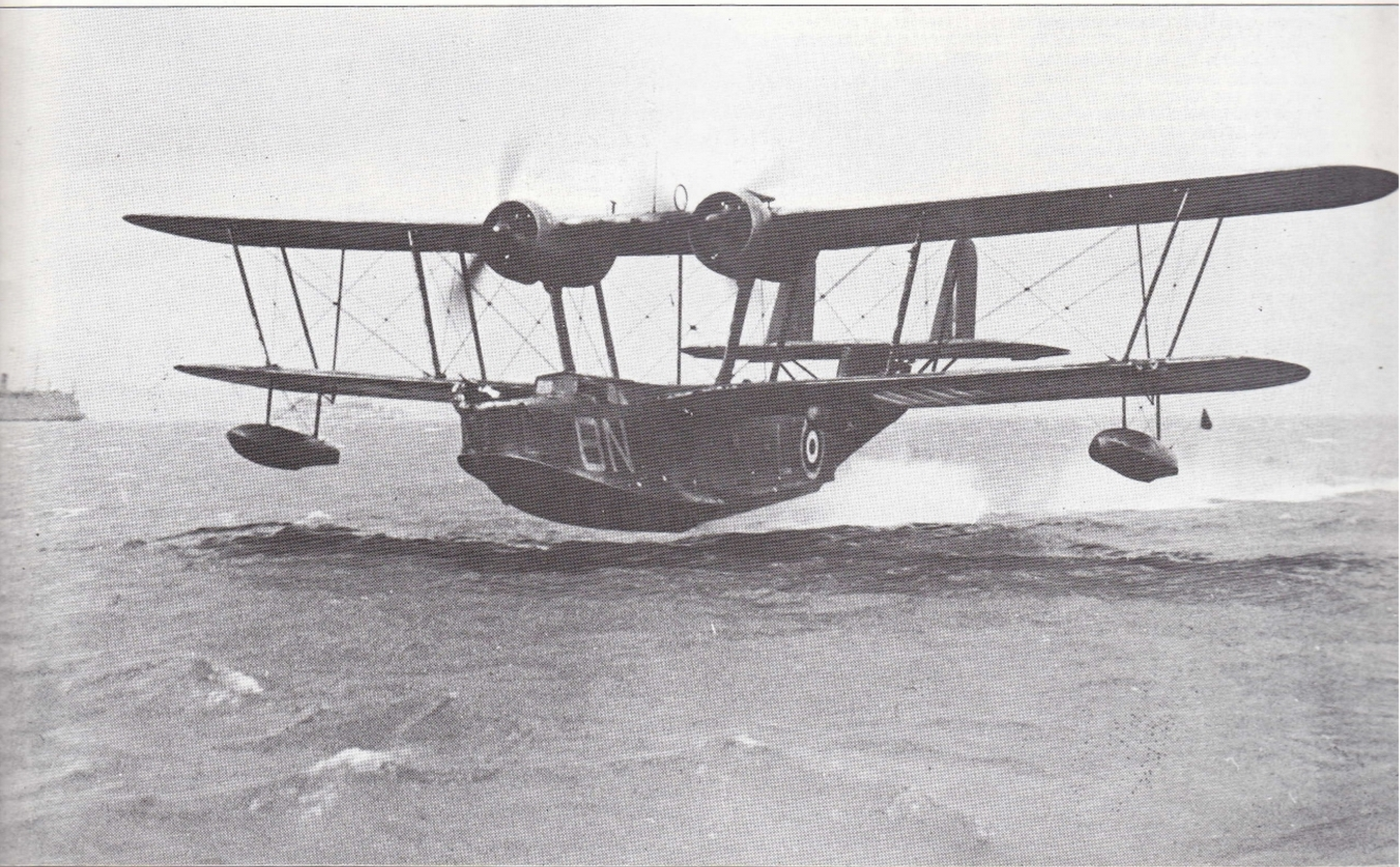
For the UK alone the work of RAF Coastal Command's flying-boats was vital for the nation's survival: given the existence of brutally effective submarine warfare, responsibility for airborne countermeasures and protection of the UK's vulnerable shipping lanes fell squarely on that command's aircrews and their Sunderlands and Catalinas.

Germany on the other hand had afforded low priority to the military flying-boat and only an adaptation of the excellent but venerable Dornier Do 18 had reached service status by 1939. The radical Blohm und Voss Bv 138 had been slow in development and suffered numerous problems before eventually achieving an acceptable combat status.

Both Japan and the United States produced really superlative military flying-boats, the Kawasaki H8K proving to possess a most impressive performance; the Catalina, of which more were produced than all other flying-boats of all nations combined, came to provide the yardstick by which all maritime reconnaissance work would be measured.

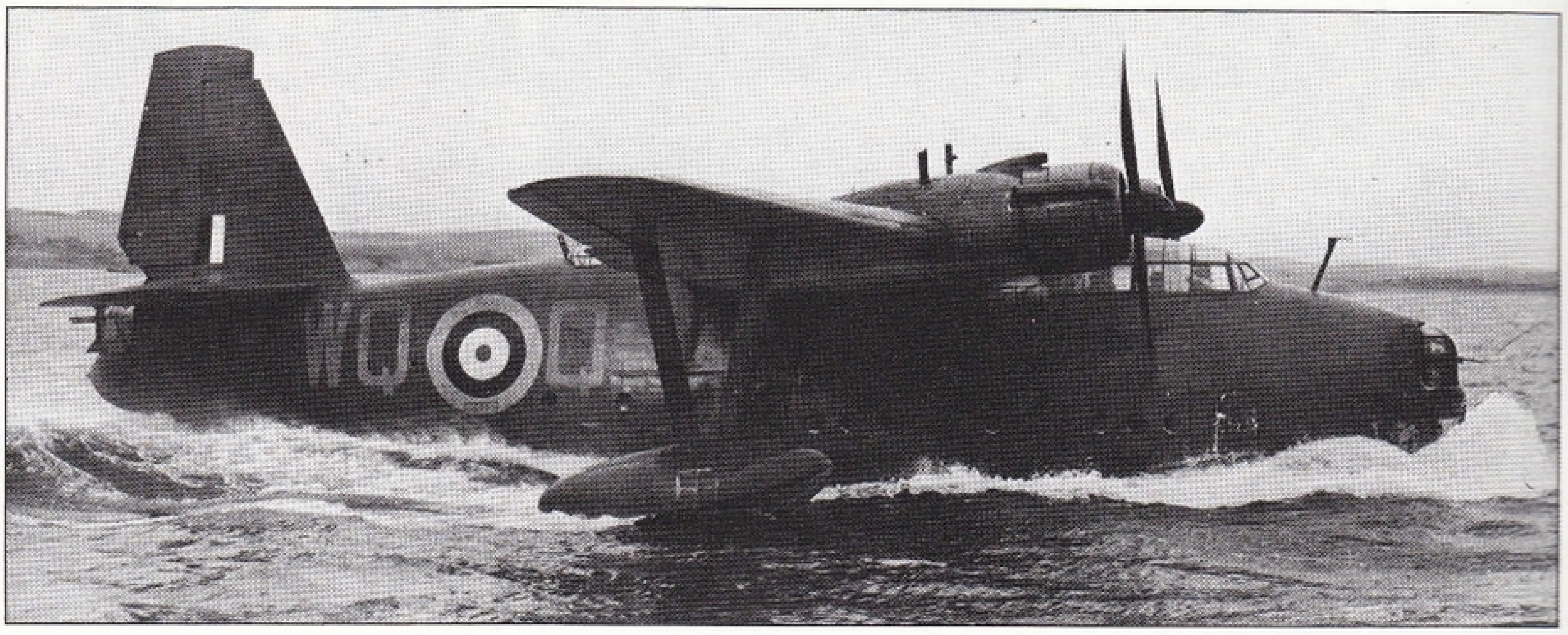
Yet World War II was to sound the death knell of the big 'boat for, even as the Catalinas and Sunderlands were ranging far over the oceans the very-long-range land-based aeroplane, exemplified by the Consolidated Liberator, was proving to be no less effective and, being more readily available and requiring none of the special base facilities of the flying-boat, pointed a different path to the future, a path that has consigned the graceful 'boats to the pages of history.

A No. 240 Sqn Supermarine Stranraer takes off from a West Coast base on convoy patrol early in the war. Just visible under the port wing is one of the early (and largely ineffective) 250-lb (113-kg) depth bombs.



UK

Saro Lerwick



The ill-fated Saro Lerwick, which served with only a single Coastal Command squadron, No. 209, at Oban, Pembroke Dock and Stranraer. As can be seen, the aircraft rode very low in the water and demanded considerable distance to become airborne.

The twin-engine **Saro Lerwick** was an attractive and compact design intended to meet a medium-range maritime reconnaissance requirement, Specification R.1/36, but was a total failure. First flown before the end of 1938, the prototype featured twin fins and rudders but from the outset was found to be seriously lacking in lateral stability, and displayed a determination to roll and yaw in cruising flight, making the aircraft impossible to fly 'hands off', a damning indictment for a maritime patrol aircraft. In due course a single fin and rudder was fitted, but not until this was considerably enlarged was any improvement in the handling characteristics discernible. Starting with the seventh production example, wing incidence was increased and enlarged propellers fitted to the Hercules II radials, but the latter were found unsuitable for operating on rough water. Moreover, stalling tests showed the Lerwick to have vicious traits, the stall under alighting conditions being accompanied by sharp wing-drop. Nevertheless 21 examples were produced and the Lerwick was first delivered for service with No. 209 Squadron in December 1939 at Oban, but after the type had flown a small number of semi-operational patrols it was decided to abandon further efforts to rectify its problems. The last eight aircraft were powered by Hercules IVs and the final example was completed in November 1940; one aircraft was flown by No. 240 Squadron but was lost on 20 February of that year, and some flew with No. 4 Operational Training Unit at Invergordon.

Specification

Saro Lerwick

Type: six-crew medium-range reconnaissance flying-boat

Powerplant: two 1,375-hp (1026-kW) Bristol Hercules II 14-cylinder air-cooled radials

Performance: maximum speed 348 km/h (216 mph) at 1220 m (4,000 ft); initial climb rate 268 m (880 ft) per minute; service ceiling 4265 m (14,000 ft)

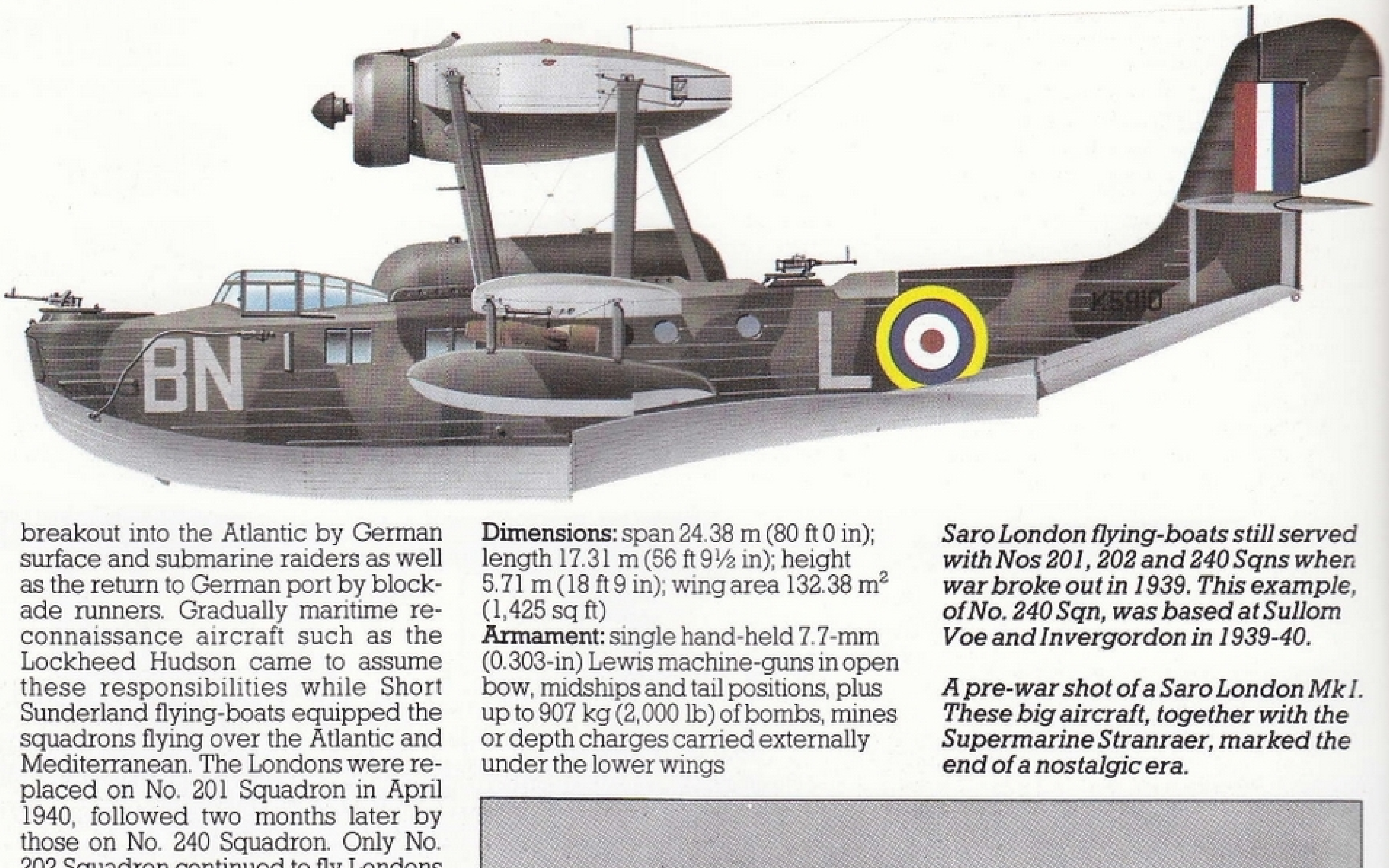
Weights: normal loaded 12928 kg (28,500 lb); overload take-off 15060 kg (33,200 lb)

Dimensions: span 24.63 m (80 ft 10 in); length 19.39 m (63 ft 7½ in); height 6.10 m (20 ft 0 in); wing area 78.50 m^2 (845 sq ft)

Armament: one 7.7-mm (0.303-in) machine-gun in nose turret, twin 7.7-mm (0.303-in) machine-guns in dorsal turret and four 7.7-mm (0.303-in) machine-guns in tail turret, plus up to 907 kg (2,000 lb) of bombs, mines or depth charges

UK

Saro London



Saro London flying-boats still served with Nos 201, 202 and 240 Sqns when war broke out in 1939. This example, of No. 240 Sqn, was based at Sullom Voe and Invergordon in 1939-40.

Reflecting the design concept of British flying-boats that had originated in the 1920s, the **Saro London** twin-engine biplane was an all-metal aircraft with fabric-covered wings and tail, and a metal-skinned hull. The type served with RAF Coastal Command during the first two years of World War II. Designed to Air Ministry Specification R.24/31, the prototype first flew in 1934 with two 750-hp (559-kW) Bristol Pegasus III radials, the engines being mounted on the top wing to be well clear of spray while taking off and landing; the prototype went on to serve for periods between 1934 and 1936 with Nos 209 and 210 Squadrons at Felixstowe and Gibraltar. Production deliveries started in March 1936 with Pegasus III engines, but from the eleventh aircraft the Pegasus X was fitted and the aircraft's designation changed to **London Mk II**, this variant equipping Nos 201 and 204 Squadrons in 1936 at Calshot and Mount Batten repectively. In 1937 they joined No. 202 Squadron at Kalafrana (Malta) and No. 228 Squadron at Pembroke Dock respectively. By the outbreak of war in September 1939 Londons still equipped No. 201 Squadron, then at Sullom Voe in the Shetland Islands, and No. 202 Squadron still at Gibraltar, while No. 240 Squadron had re-equipped with Londons in July 1939 and was stationed at Invergordon. These flying-boats carried out sea patrols over the North Sea and the Mediterranean, some aircraft being fitted with a large dorsal fuel tank to increase their range. Bombs, depth charges and (occasionally) mines up to a total weight of 2,000 lb (907 kg) could be carried under the lower wing roots. Indeed, the old biplanes undertook a considerable share of the patrol work over the North Sea, keeping watch for the likely breakout into the Atlantic by German surface and submarine raiders as well as the return to German port by blockade runners. Gradually maritime reconnaissance aircraft such as the Lockheed Hudson came to assume these responsibilities while Short Sunderland flying-boats equipped the squadrons flying over the Atlantic and Mediterranean. The Londons were replaced on No. 201 Squadron in April 1940, followed two months later by those on No. 240 Squadron. Only No. 202 Squadron continued to fly Londons at Gibraltar until June 1941.

Specification

Saro London Mk II

Type: six-crew coastal reconnaissance flying-boat

Powerplant: two 920-hp (686-kW) Bristol Pegasus X nine-cylinder air-cooled radials

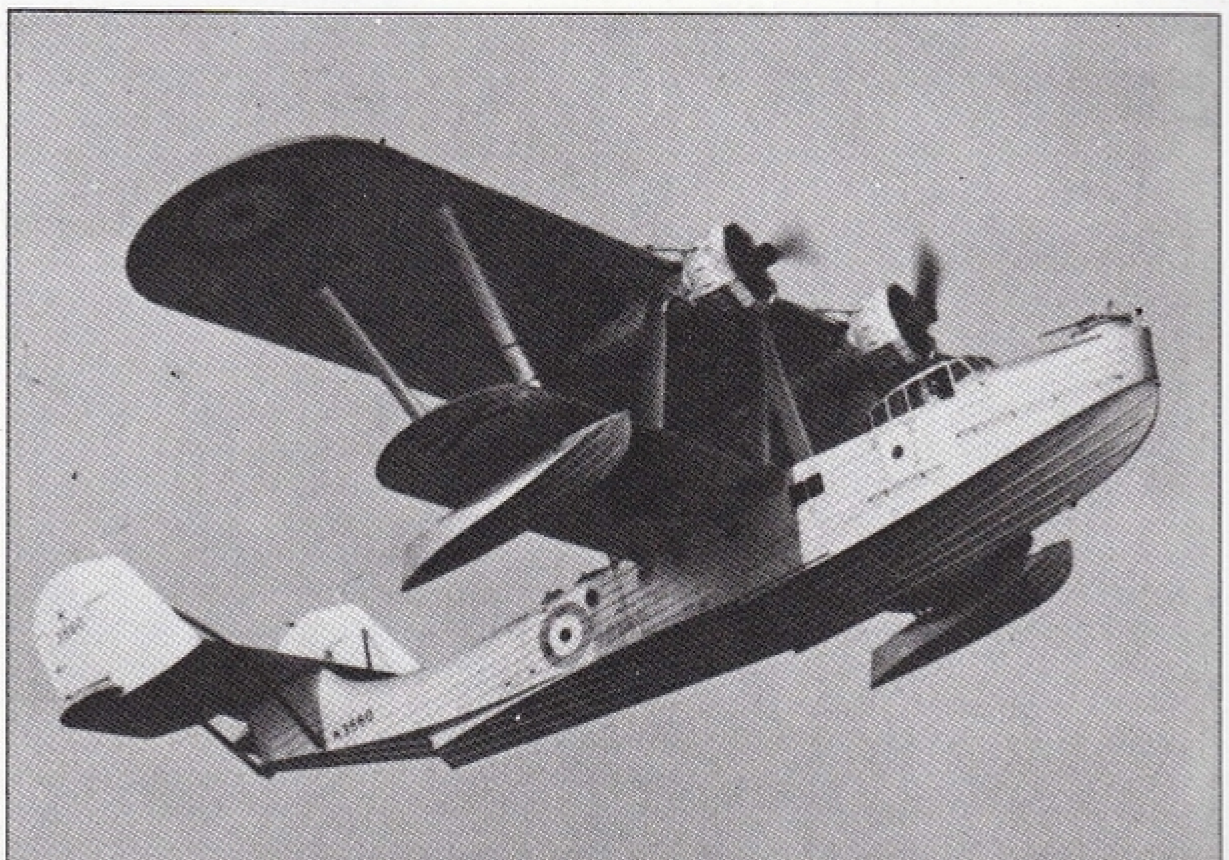
Performance: maximum speed 228 km/h (142 mph) at sea level; initial climb rate 360 m (1,180 ft) per minute; service ceiling 6065 m (19,900 m); maximum range 2800 km (1,740 miles)

Weights: empty 5035 kg (11,100 lb); maximum take-off 9979 kg (22,000 lb)

Dimensions: span 24.38 m (80 ft 0 in); length 17.31 m (56 ft 9½ in); height 5.71 m (18 ft 9 in); wing area 132.38 m^2 (1,425 sq ft)

Armament: single hand-held 7.7-mm (0.303-in) Lewis machine-guns in open bow, midships and tail positions, plus up to 907 kg (2,000 lb) of bombs, mines or depth charges carried externally under the lower wings

A pre-war shot of a Saro London Mk I. These big aircraft, together with the Supermarine Stranraer, marked the end of a nostalgic era.

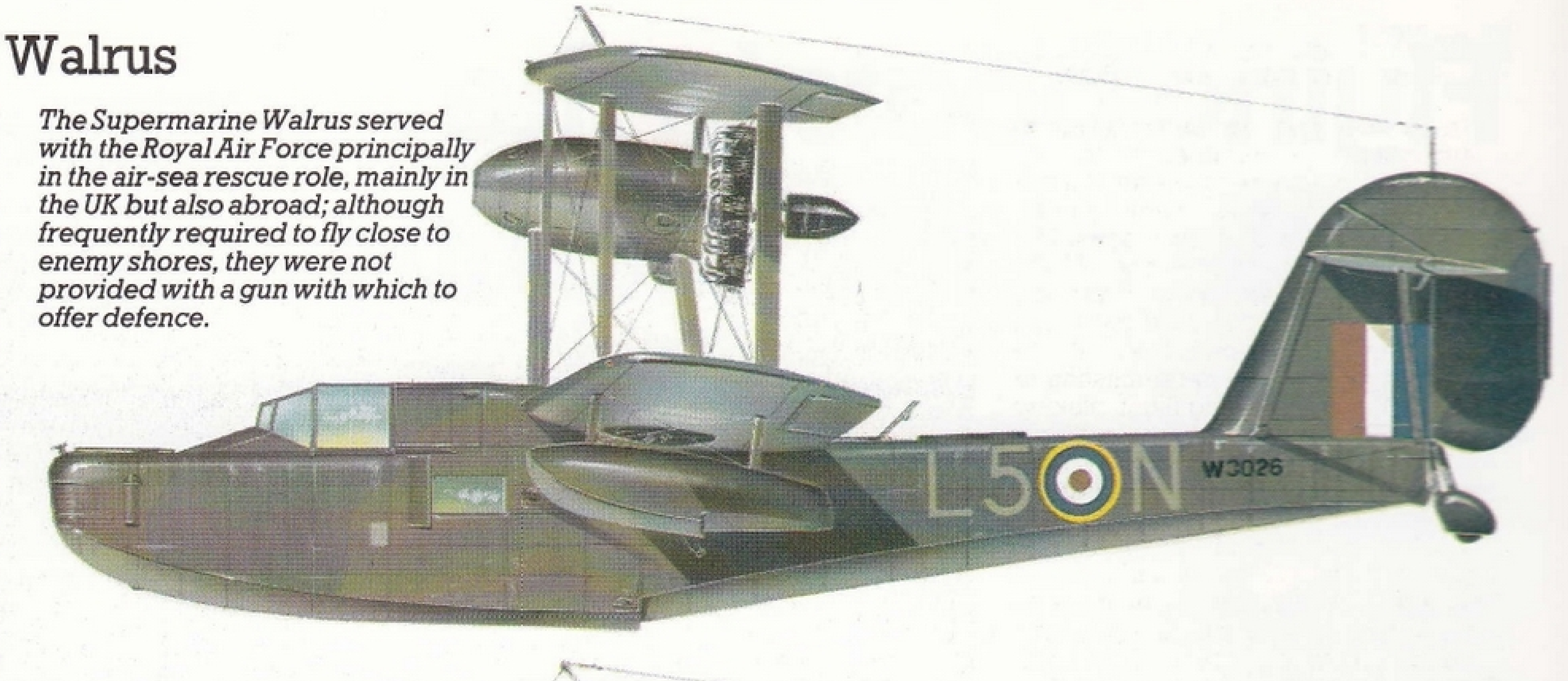


UK

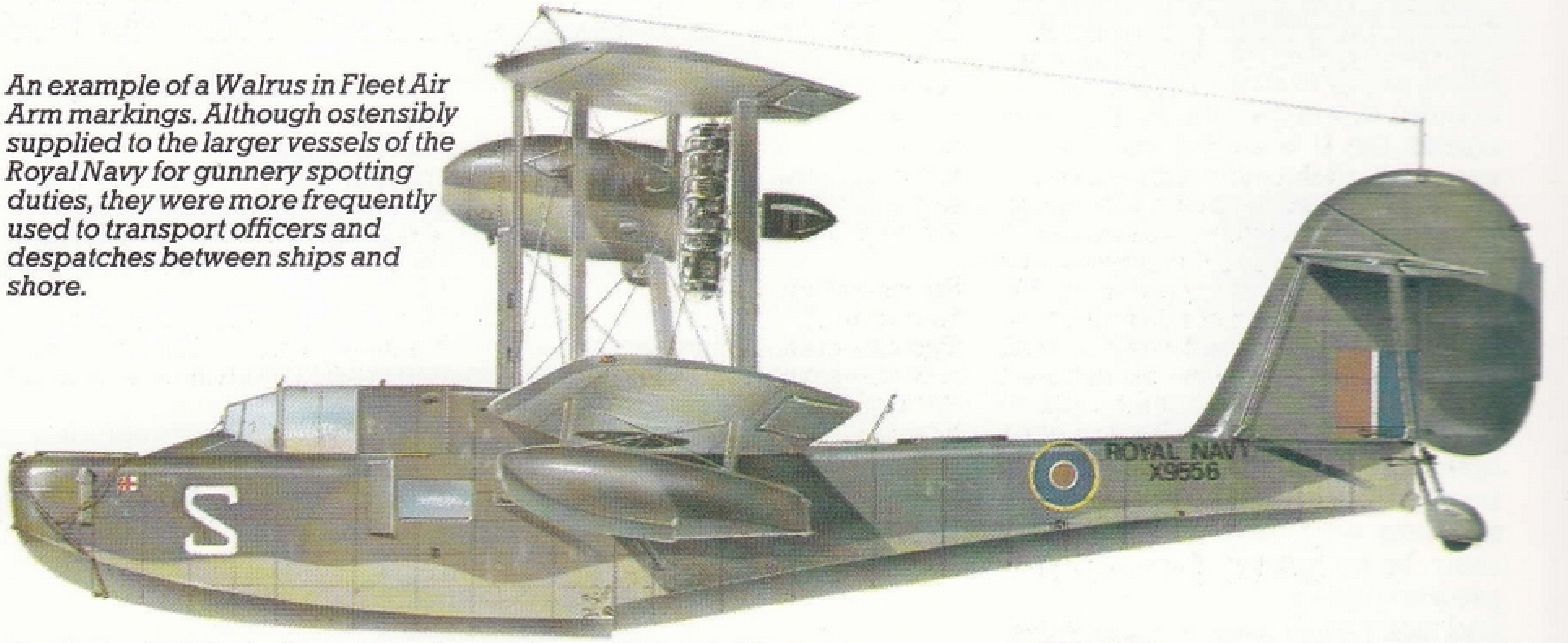
Supermarine Walrus

One of the unsung heroes of World War II, the **Supermarine Walrus** amphibian was a private venture development of the 1922 Seagull I, and indeed first flew as the **Seagull V** on 21 June 1933. A production order by the Australian government prompted evaluation by the Royal Navy's No. 702 Catapult Flight, which in turn led to an initial contract for 12 **Walrus Mk I** aircraft being placed by the Air Ministry in 1935. Following further trials, during which a Walrus was catapulted fully-loaded from HMS *Nelson*, production orders for 204 aircraft with the 635-hp (474-kW) Pegasus II M2 radial were placed, and the little flying-boat entered Fleet Air Arm service in 1936. Early in World War II Walrus amphibians were serving aboard battleships and cruisers of the Royal Navy all over the world as components of No. 700 Squadron, as well as with Nos 701, 711, 712 and 714 Squadrons, their principal duties being over-the-horizon search for enemy shipping; they were also employed for gunnery spotting, anti-submarine and convoy protection duties. A Walrus was even catapulted from the cruiser HMS *Dorsetshire* to bomb a target in Italian Somaliland on 18 November 1940.

Undoubtedly the work for which the Walrus (affectionately known as the Shagbat) will be best remembered was air/sea rescue, serving in this role with Nos 269, 275, 276, 277, 278, 281 and 282 Squadrons at stations in the United Kingdom, and with Nos 283, 284, 292 and 294 Squadrons in the Middle East. Called out in any weather, day or night, Walrus air/sea rescue aircraft frequently alighted in enemy coastal waters to pick up ditched Allied airmen from their dinghies, sometimes putting down in minefields where rescue launches could not venture. With their curious pusher engine nacelle located between the wings (and angled off centre), the sight of a Walrus to a shot-down airman meant the difference between rescue and years in a prison camp. The Walrus was slowly replaced in service from 1944 onwards by the tractor Mercury-powered Sea Otter from the same stable, although No. 624 Squadron was re-formed at Grottaglie in Italy in December that year with Walrus aircraft for mine-spotting duties. A total of 740 Walrus aircraft was built, production of the Walrus Mk I with metal-clad hull being terminated at Supermarine after 287 had been completed; thereafter production was switched to Saunders-Roe who built 453 **Walrus Mk II** aircraft with wooden hulls before finally ending in January 1944.



The Supermarine Walrus served with the Royal Air Force principally in the air-sea rescue role, mainly in the UK but also abroad; although frequently required to fly close to enemy shores, they were not provided with a gun with which to offer defence.



An example of a Walrus in Fleet Air Arm markings. Although ostensibly supplied to the larger vessels of the Royal Navy for gunnery spotting duties, they were more frequently used to transport officers and despatches between ships and shore.

Specification

Supermarine Walrus Mk II

Type: three/four-crew shipboard observation and air/sea rescue amphibian flying-boat

Powerplant: one 775-hp (578-kW) Bristol Pegasus VI nine-cylinder air-cooled radial

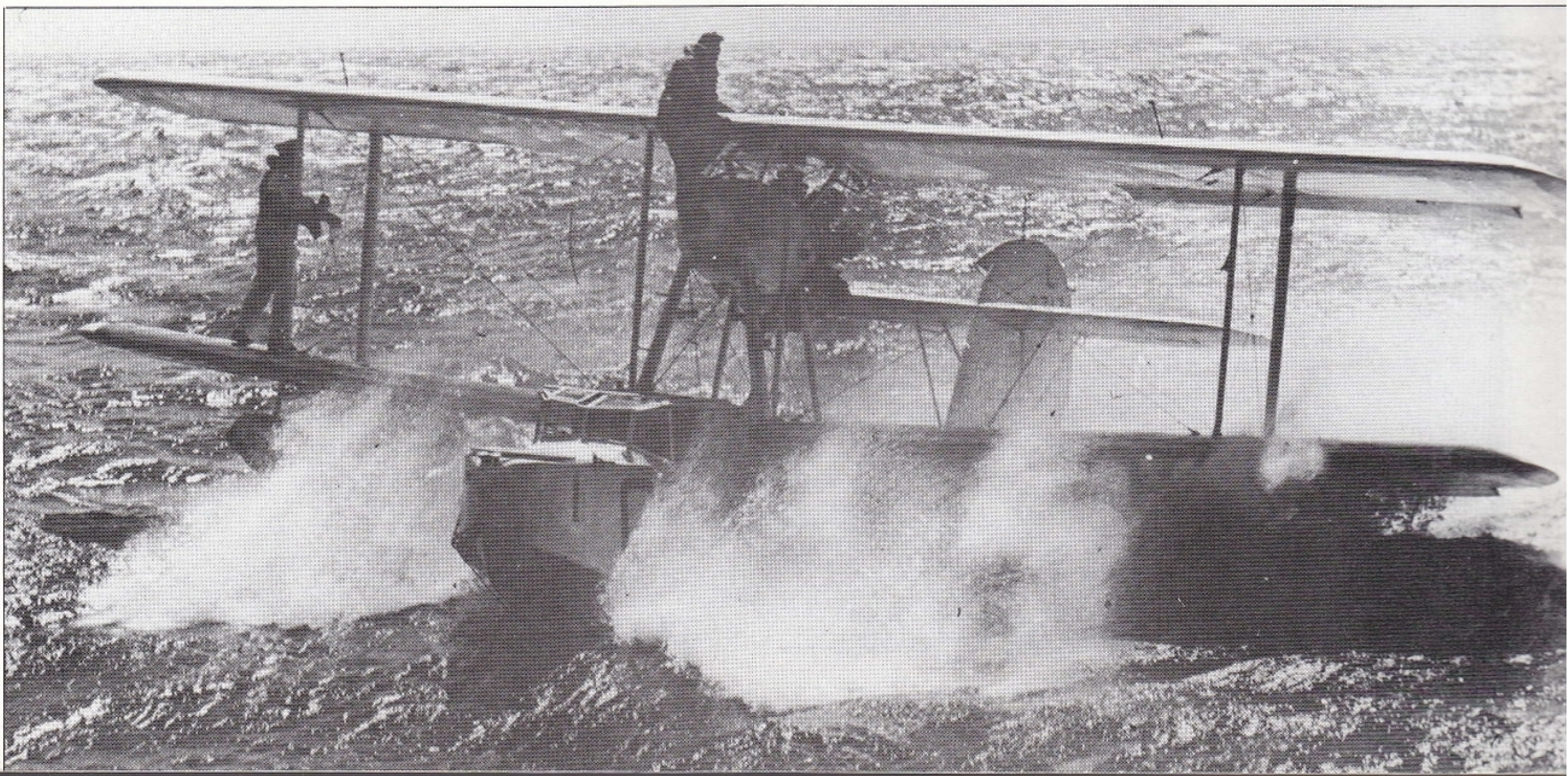
Performance: maximum speed 200 km/h (124 mph) at sea level; initial climb rate 320 m (1,050 ft) per minute; service ceiling 5640 m (18,500 ft); range 965 km (600 miles)

Weights: empty 2223 kg (4,500 lb); maximum take-off 3266 kg (7,200 lb)

Dimensions: span 13.97 m (45 ft 10 in); length 11.45 m (37 ft 7 in); height 4.65 m (15 ft 3 in); wing area 56.67 m^2 (610 sq ft)

Armament: one 7.7-mm (0.303-in) machine-gun on open bow position, plus up to 227 kg (500 lb) of bombs or depth charges on underwing racks (shipboard version only)

A Walrus taxis in to be hoisted aboard its parent cruiser; the crew member perched beside the engine nacelle will attach the lifting gear to a lug in the top wing for hoisting.



Flying-boats in the Battle of the Atlantic

During World War II Britain was dependent on imported food, raw materials and armaments, all brought in by sea in lumbering convoys of ships. German surface raiders and submarine packs inflicted terrible casualties, and Britain's survival rested on the efforts of the Royal Navy and the crews of RAF Coastal Command's Sunderlands, Catalinas and Liberators.

The Battle of the Atlantic was waged, but seldom raged, from the first day of World War II until the last. It was in effect as much a battle of survival for the UK as one of protecting the Allies' ability to strike back at Hitler's Germany in order to win the war. As such it was a battle against the U-boat and German surface raiders, in which the eyes of the Allied navies were in the long range maritime reconnaissance aircraft.

During the two years in which the UK fought virtually alone, from mid-1940 to mid-1942, Royal Air Force Coastal Command flew Short Sunderlands spread fairly thinly at bases from Iceland to Gibraltar. These fine big 'boats gave magnificent service, scouring the ocean for enemy raiders and submarines, meeting inbound convoys from the Americas and the southern seas, and shepherding them in to their home ports. Their efficiency against prowling enemy submarines was strictly limited to the hours of daylight, however, and then only within the scope of human vision; moreover, their excellent flight endurance and range was severely reduced by the need to keep within touch of crawling convoys whose speed seldom exceeded about 10 kts.

With the arrival in RAF service of the American Consolidated PBY Catalina early in 1941, with its greater cruising range and lower cruising speed, the whole gamut of maritime reconnaissance was vastly increased so that by early 1943 RAF Coastal Command possessed no fewer than 15 squadrons of flying-boats based on the Atlantic's eastern seaboard. Furthermore, the introduction of ASV radar and the Leigh Light (an airborne searchlight that could illuminate a surfaced U-boat at night) considerably increased the efficiency of the patrolling boats.

From the outset the Sunderland (and later the Catalina) played a vital part in the Battle of the Atlantic, but it must be remembered that for every sortie on which contact with the enemy was made there were literally hundreds of tedious, uneventful and seemingly endless flights, often in atrocious weather, invariably without visual navigation checkpoints but always demanding constant scanning of the ocean wastes.

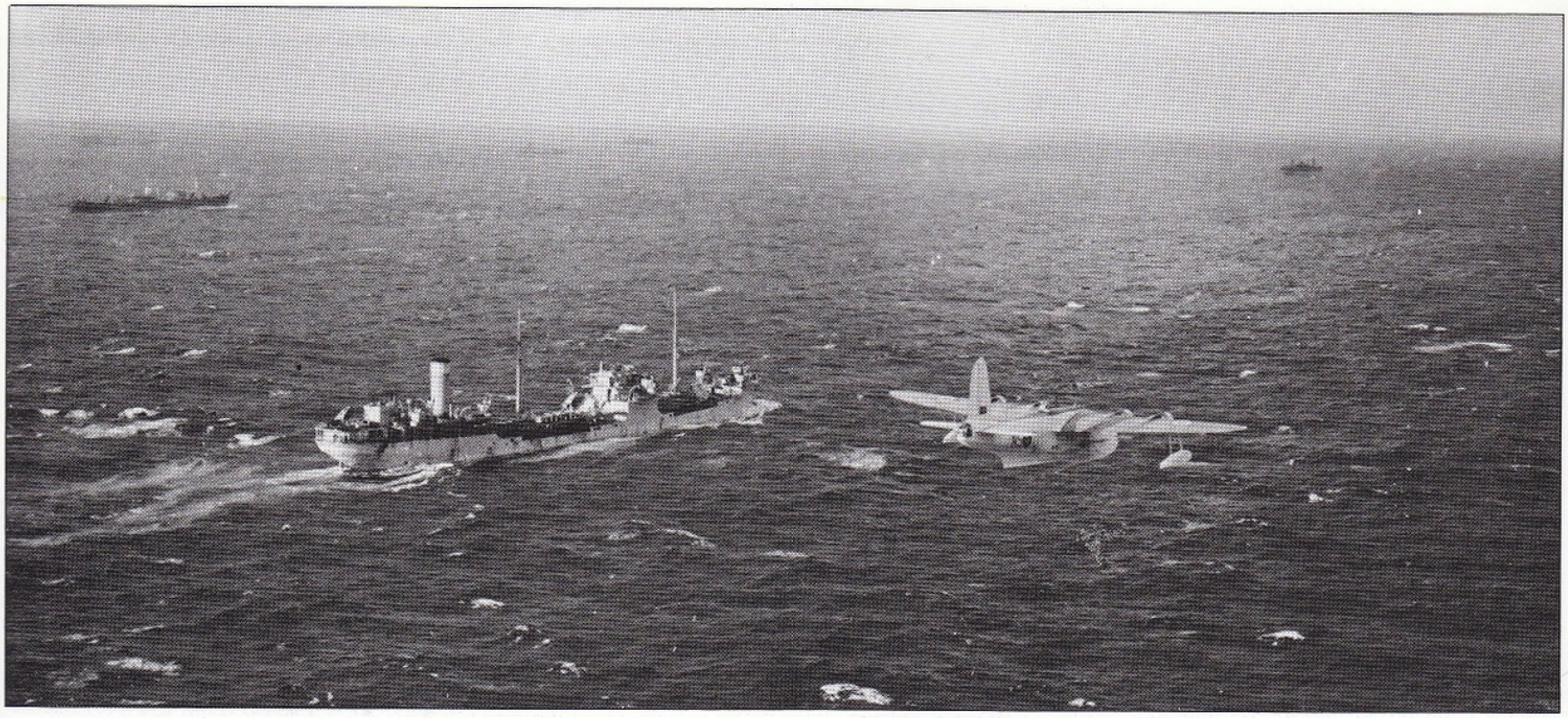
As early as 30 January 1940 a Sunderland crew 'claimed' the destruction of Coastal Command's first U-boat when an enemy submarine commander, on sighting the approaching flying-boat, preferred to scuttle his craft to the rigours of a depth charge attack. Much later in the war, when German U-boat commanders often preferred to remain surfaced and to fight it out with their attackers, Sunderlands were armed with additional forward-firing machine guns in addition to the pair in the bow turret. In January 1944 a Sunderland of No. 10 Squadron, RAAF, based in the UK, found such a U-boat and engaged it with this front armament, killing all the enemy gunners, and then sank the submarine with depth charges.

One of the most outstanding actions involving the work of Coastal Command Catalinas was that which culminated in the sinking of the *Bismarck* in May 1941. During the only cruise of Germany's latest battleship Coastal Command aircraft had already relayed the vital news that the warship had broken out of the North Sea, in company with the cruiser *Prinz Eugen*, but, when four days later British warships lost contact south of Iceland and it seemed likely that a powerful raiding force was loose in the Atlantic, it was a Catalina of No. 209 Squadron flying from Northern Ireland that first located the enemy ships, a similar aircraft from No. 240 Squadron then continuing to shadow them until the heavy ships of the Royal Navy could bring the *Bismarck* to final action.

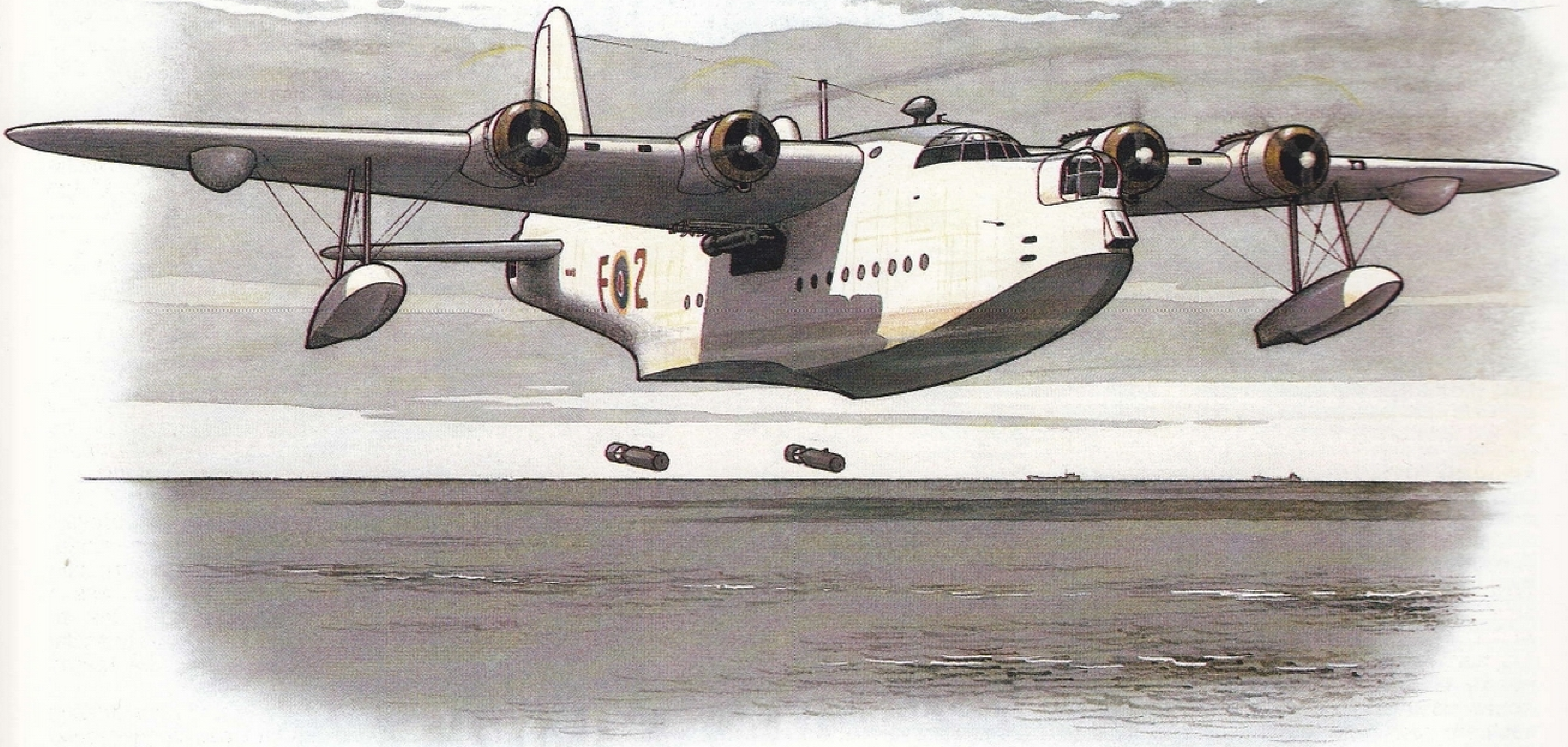
In mid-1941 RAF Sunderlands extended their area of patrol southwards in the Atlantic when No. 95 Squadron moved from South Wales to Freetown in Sierra Leone, thereby giving greater protection to convoys forced to sail the Cape route by the closure of the Mediterranean. It was during the preparations for the 'Torch' landings and the protection of the invasion convoys themselves, in late 1942, however, that the West African and Gibraltar-based flying-boats really came to be valued, although a relatively small and unimportant convoy northbound from Sierra Leone was to be sacrificed to German U-boats in the interests of giving maximum protection to a vital convoy sailing to Gibraltar from the United Kingdom.

Of all the facets of the Battle of the Atlantic none was more demanding than the protection afforded by flying-boats to the North Cape convoys, sailing from Iceland to the ports of northern USSR. The task involved covering convoys as far east from Iceland and Scotland as possible, and until mid-1942 the Germans interfered little with the passage of Allied ships. However, after heavy losses by PQ16 in May 1942, which could not be prevented by RAF Sunderlands

A Sunderland Mk III of No. 201 Sqn accompanies a deep sea convoy in the Western Approaches during the latter half of the war. After days and nights of attacks by U-boats, in-bound convoys drew much comfort from the appearance of these home-based boats.



Epitomizing British flying-boat design was the Short Sunderland, depicted here releasing a pair of depth charges; racks for these weapons were swung out on rails from inside the hull, under the wing roots.



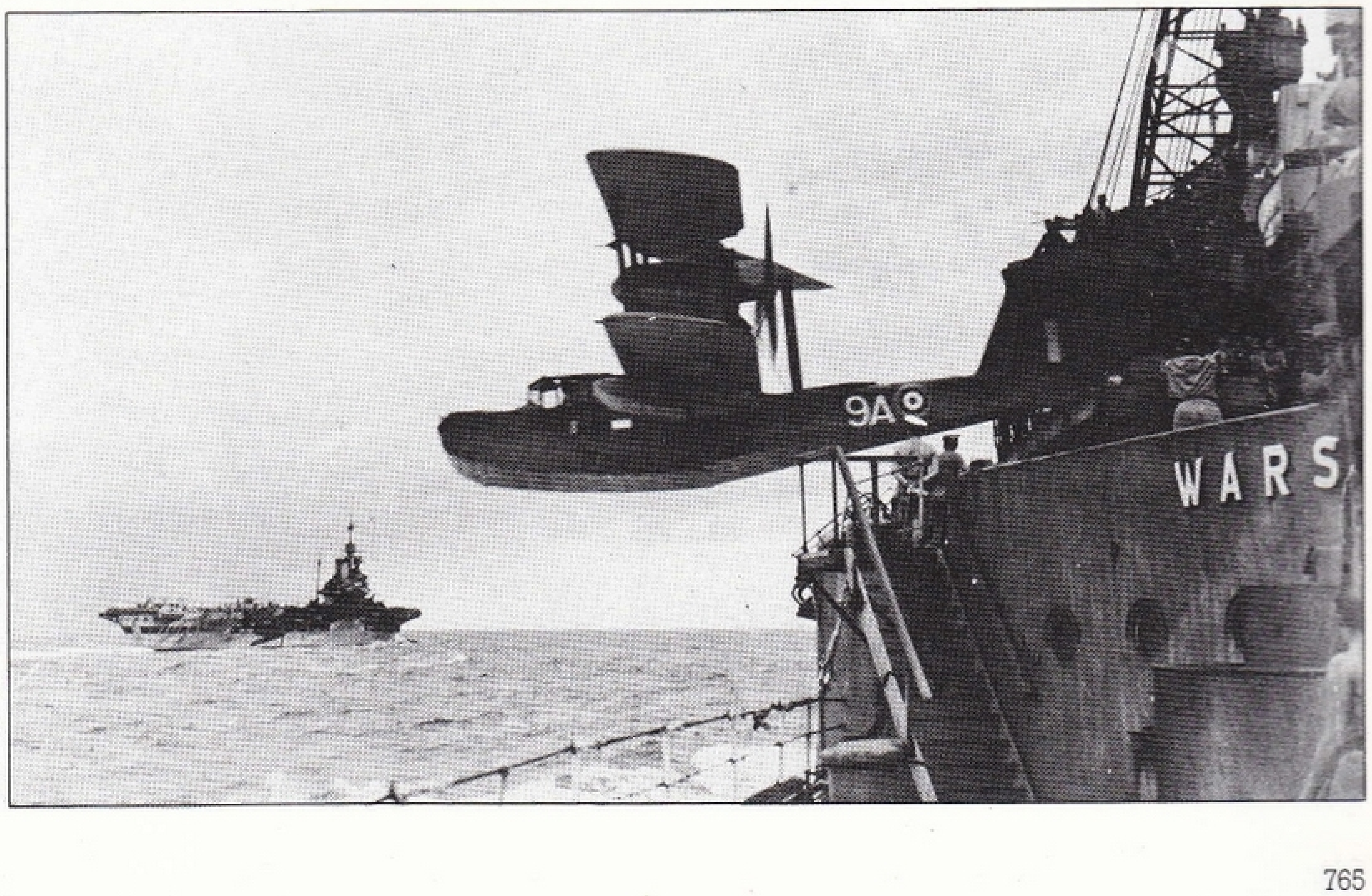
and American-flown PBYs from Iceland and Scotland alone, it was decided to detach eight Catalinas of Nos 210 and 240 Squadrons to the Soviet ports to narrow the gap in which German U-boats were likely to attack. Apart from the dangers presented by action with the enemy, the long patrol flights in the Arctic north imposed conditions which far surpassed even those of the Atlantic, while the possibility of ditching in those icy waters was ever in the minds of the patrolling crews.

One against six

Early in the war Sunderlands were the RAF's longest-ranged aircraft, and flew many important VIP missions. Not much was seen of the Luftwaffe, and then on 3 April 1940 a Sunderland on patrol over a small North Sea convoy ran into six Junkers Ju 88s of KG 30. By all rights the fight ought to have been one-sided, but the Sunderland dived right down to sea level, to protect its defenceless belly, and was then manoeuvred with such care, the crew keeping up a running commentary on the positions of the Ju 88s, that for a period of more than half an hour it sustained not one lethal hit, though plenty of repairable damage. Meanwhile, its rear gunner shot one Ju 88 down in flames, and so seriously damaged another that it limped off and made a forced landing in Norway, which was to be invaded by Germany just six days later. The other four Ju 88s gave up and flew away, and it was this action which resulted in the *Stachelschwein* epithet.

More than 200 air combats took place subsequently, against such opponents as two Messerschmitt Bf 110s, two Dornier Do 18s, two Arado Ar 196B cannon-armed seaplanes and a Focke-Wulf Fw 200C Condor, but the most remarkable of all was one in 1943 when a radar-burdened Sunderland Mk III took on eight Ju 88s over the Bay of Biscay. By this time the Ju 88s had a mix of 20-mm cannon and 13-mm (0.51-in) guns in their armament, yet the Sunderland, from No. 461 Squadron, RAAF, shot down three and then limped home, splattered by over 500 gashes from enemy hits, and made a successful landing on the first beach it came to. Another RAAF unit, the famed No. 10 Squadron from Mount Batten (Plymouth), was the first to fit four fixed Brownings in the bows to fire on surfaced U-boats. Though no match for the eight 20-mm then commonly fitted as U-boat flak, it was enough to deter the flak crews, which on 1 August 1943 had shot down one of the unit's aircraft before the submarine, *U-454*, was itself sunk by the flying-boat's last courageous run. At last on 8 January 1944 No. 10 Squadron caught *U-426* on the surface and kept up such a fire with the front guns that, from 1100 m (1,200 yards) out, it made a run without being itself shot down. The depth charges sank the U-boat with this one run. With 28 RAF squadrons equipped, Sunderland epics are without number. Not least was the time (on 29 May 1943) when mountainous seas punched a hole in a Sunderland's hull 2.7 by 1.8 m (9 ft by 6 ft), the incoming mass of water almost taking the tail clean off. The flying-boat was calmly put down on Angle airfield in Pembroke, without further damage.

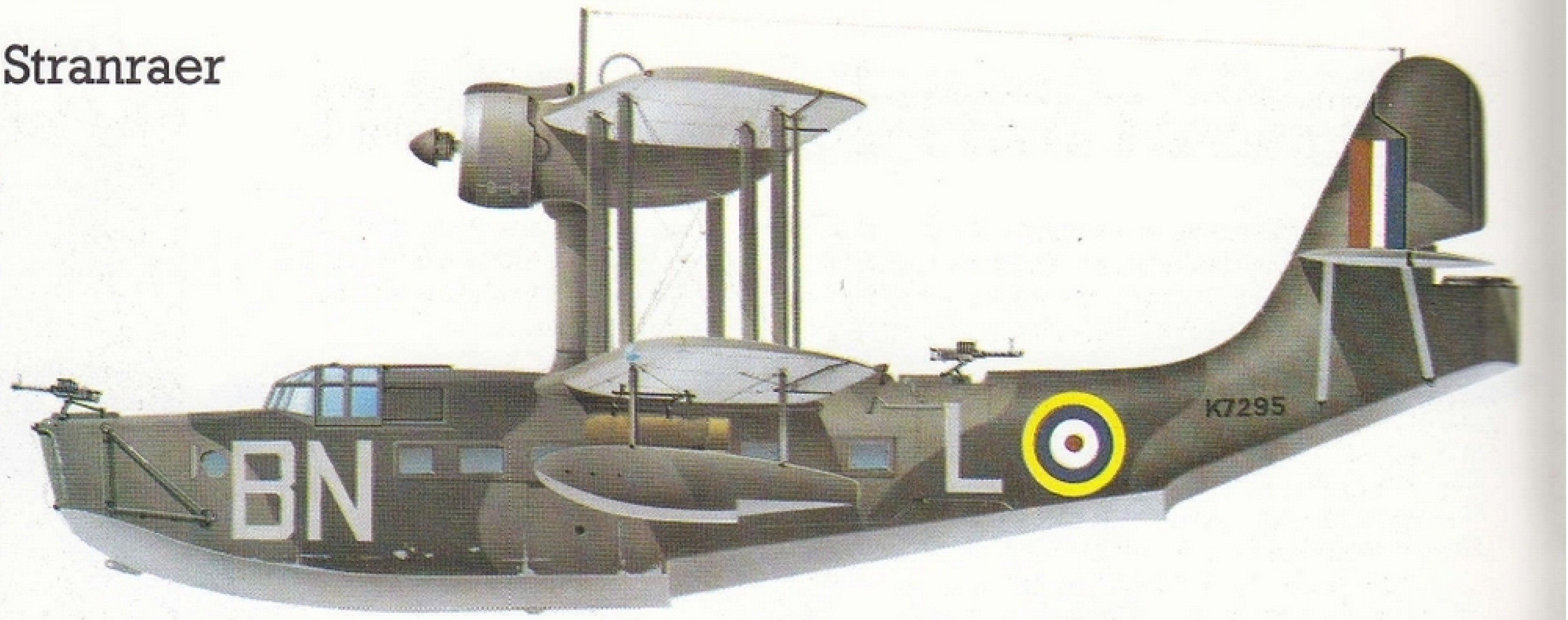
A Supermarine Walrus is catapulted from the battleship HMS* Warspite *during the early months of the war, almost certainly on a communications flight rather than a spotting sortie.



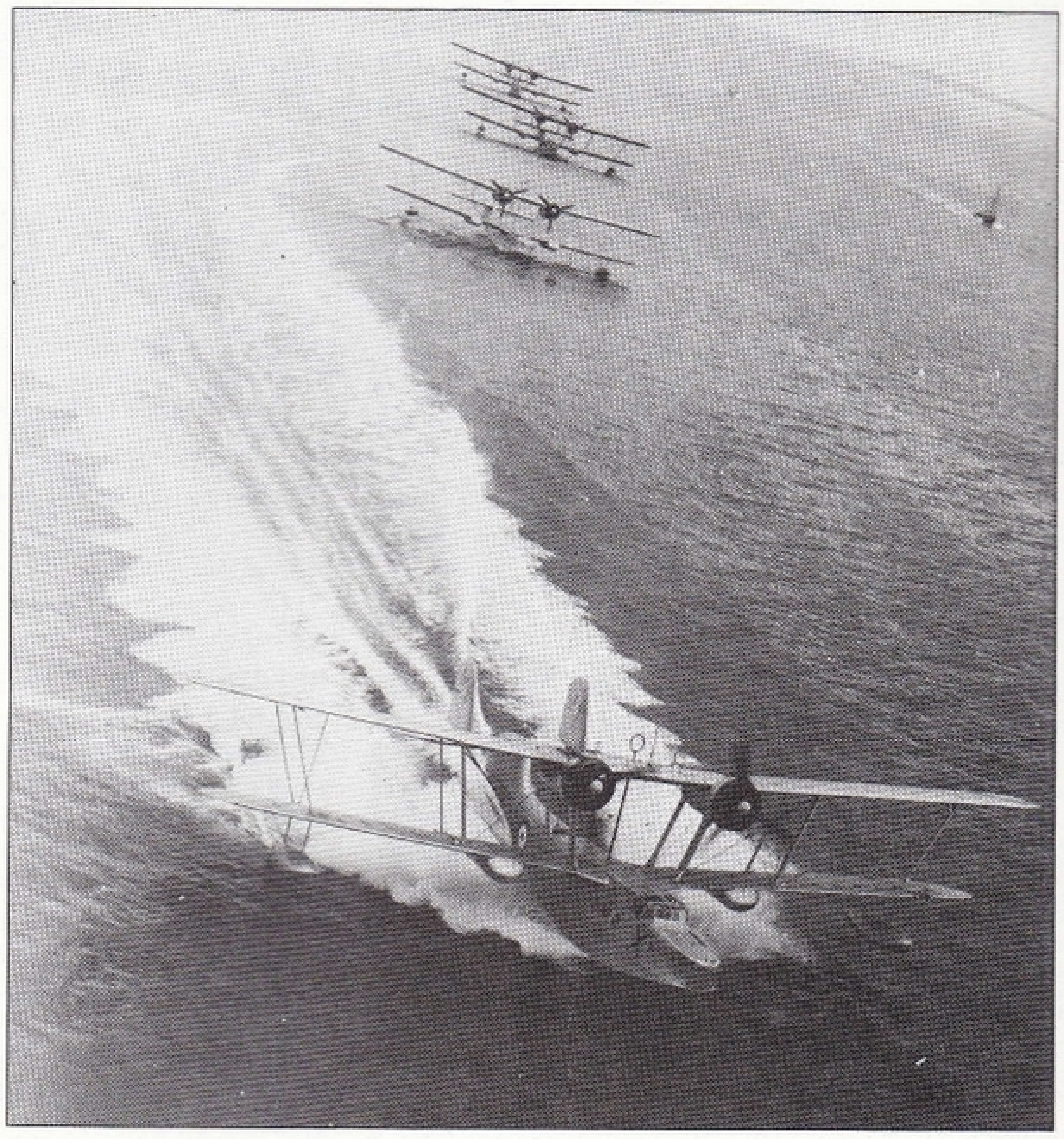
UK

Supermarine Stranraer

Designed to the same specification, R.24/31, as the Saro London, the **Supermarine Stranraer** twin-engine biplane flying-boat survived in service slightly longer than the other, and was generally preferred by those crews who were able to compare the two types. The prototype, originally known as the **Singapore V**, was powered by Bristol Pegasus IIIM radials driving two-blade wooden propellers and first flew in mid-1935, but was immediately renamed Stranraer. It also underwent comparative trials with the London on No. 210 Squadron in October and November 1935, during which it was found to be somewhat underpowered. Production deliveries of aircraft powered by a pair of Pegasus X radials driving a three-blade Fairey Reed metal propeller started December 1936, and the type was declared operational in April the following year with No. 228 Squadron at Pembroke Dock, remaining with this squadron until April 1939. In December 1938 Stranraers joined No. 209 Squadron at Felixstowe, and later moving to Invergordon and Oban for patrols over the North Sea until supplanted by the ill-fated Lerwick the following year. No. 240 Squadron was the only other RAF Coastal Command squadron to fly the Stranraer, converting to the aircraft in June 1940 at Pembroke Dock for short-range patrol work over the Western Approaches; the Stranraers were eventually replaced by Catalina 'boats in March 1941. Although RAF Stranraers did not serve at overseas stations, a total of 40 aircraft was licence-built by Canadian-Vickers between 1939 and 1941, and served in the coastal reconnaissance/anti-submarine role with the RCAF until finally replaced by the Consolidated Canso (Catalina) during 1943.



Above: No. 240 Sqn Stranraer flying-boat K7295 based at Pembroke Dock, South Wales, in 1940 for patrols over the Western Approaches; in July that year the squadron moved to Oban and converted to Catalina boats the following March.



Right: A quartet of Stranraers of No. 209 Sqn at Felixstowe, Suffolk, in May 1939. Note the absence of camouflage (applied on the outbreak of war) and the underwing fuel tanks. Just before the war the squadron moved north to Invergordon.

Specification

Supermarine Stranraer
Type: seven-crew coastal reconnaissance flying-boat
Powerplant: two 920-hp (686-kW) Bristol Pegasus X nine-cylinder air-cooled radials
Performance: maximum speed 241 km/h (150 mph) at sea level; initial climb rate 411 m (1,350 ft) per minute; service ceiling 5640 m (18,500 ft); range 1609 km (1,000 miles)
Weights: empty 5103 kg (11,250 lb); maximum take-off 8618 kg (19,000 lb)
Dimensions: span 25.91 m (85 ft 0 in); length 16.71 m (54 ft 10 in); height 6.63 m (21 ft 9 in); wing area 135.36 m^2 (1,457 sq ft)
Armament: single hand-held 7.7-mm (0.303-in) machine guns in open bow, midships and tail positions, plus up to 454 kg (1,000 lb) of bombs, mines or depth charges carried on underwing racks

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UK

Short Sunderland

The graceful Short C-class 'Empire' flying-boat, ordered for Imperial Airways in 1934, marked the greatest-ever single step forward in the design of the flying-boat and, with the issue of a military specification, R.2/33, for a four-engine monoplane reconnaissance flying-boat, it was perhaps logical to adapt the new airliner to meet this requirement. The first prototype **Short Sunderland** was flown in October 1937 and was followed only eight months later by the first production **Sunderland Mk I** aircraft. By the outbreak of war four squadrons, No. 204 at Sullom Voe, No. 210 at Pembroke Dock, No. 228 returning to the UK from Egypt and No. 230 at Singapore, had been equipped with the Sunderland Mk I. The big 'boat was quickly in the news when, on 21 September 1939, two aircraft of Nos 204 and 228 Squadrons rescued the entire crew of the torpedoed merchantman *Kensington Court*. In January 1940 a U-boat scuttled itself on sighting an aircraft of No. 228 Squadron. Some 75 Sunderland Mk Is were produced and went on to equip Nos 95, 201 and 270 Squadrons before the **Sunderland Mk II** with Pegasus XVIII radials and ASV.Mk II radar was introduced at the end of 1941, a year which saw Sunderlands carrying to safety hundreds of British troops during the evacuation of Greece and Crete. A total of 55 Sunderland Mk IIs were built by Short Bros and Blackburn, equipping Nos 119, 201, 202, 204, 228 and 230 Squadrons. The **Sunderland Mk II** introduced a new planing bottom to the hull, the less pronounced forward step giving better unstick characteristics; 407 of this version (including the **Sunderland Mk IIIA** with ASV.Mk III radar) were produced by the same two manufacturers and joined Nos 95, 119, 201, 202, 204, 228, 230, 246, 270, 330 and 343 Squadrons. Late in 1943 the final production version, the **Sunderland Mk V** with Pratt & Whitney engines and ASV.Mk VIc radar, started to appear; 143 examples of this version were produced, and by the end of the war Sunderlands equipped no fewer than 28 RAF squadrons the world over. Very early in the war this fine aeroplane had earned the German nickname *Stachelschwein* (porcupine) on account of its ability to defend itself with its bristling machine-guns, and indeed the Sunderland gained an impressive war record, often having to engage U-boats on the surface (and sinking many of them), and being engaged by enemy fighters and other aircraft. Yet for all its spectacular achievements, the Sunderland's real contribution to the war at sea lay in the long, monotonous patrols far out over the oceans in company with the UK's shipping convoys, when the mere presence of the big 'boat was enough reason to discourage many a U-boat commander from launching an attack.

Specification

Short Sunderland Mk V
Type: 10-crew long-range maritime reconnaissance flying-boat
Powerplant: four 1,200-hp (895-kW) Pratt & Whitney R-1830-90 Twin Wasp 14-cylinder air-cooled radials
Performance: maximum speed 349 km/h (213 mph) at 1525 m (5,000 ft); climb to 3660 m (12,000 ft) in 16.0 minutes; service ceiling 5445 m (17,900 ft); normal range 4765 km (2,960 miles)
Weights: empty 16738 kg (36,900 lb); maximum take-off 27216 kg (60,000 lb)
Dimensions: span 34.36 m (112 ft 9½ in); length 26.00 m (85 ft 3½ in); height 10.52 m (34 ft 6 in); wing area 138.14 m^2 (1,487 sq ft)
Armament: two fixed forward-firing 7.7-mm (0.303-in) machine-guns, two 7.7-mm (0.303-in) machine-guns each in bow and dorsal turrets, and four 7.7-mm (0.303-in) in tail turret, plus a bombload of up to 2250 kg (4,960 lb) of bombs, mines or depth charges on retractable racks in hull sides

Sunderland in Action

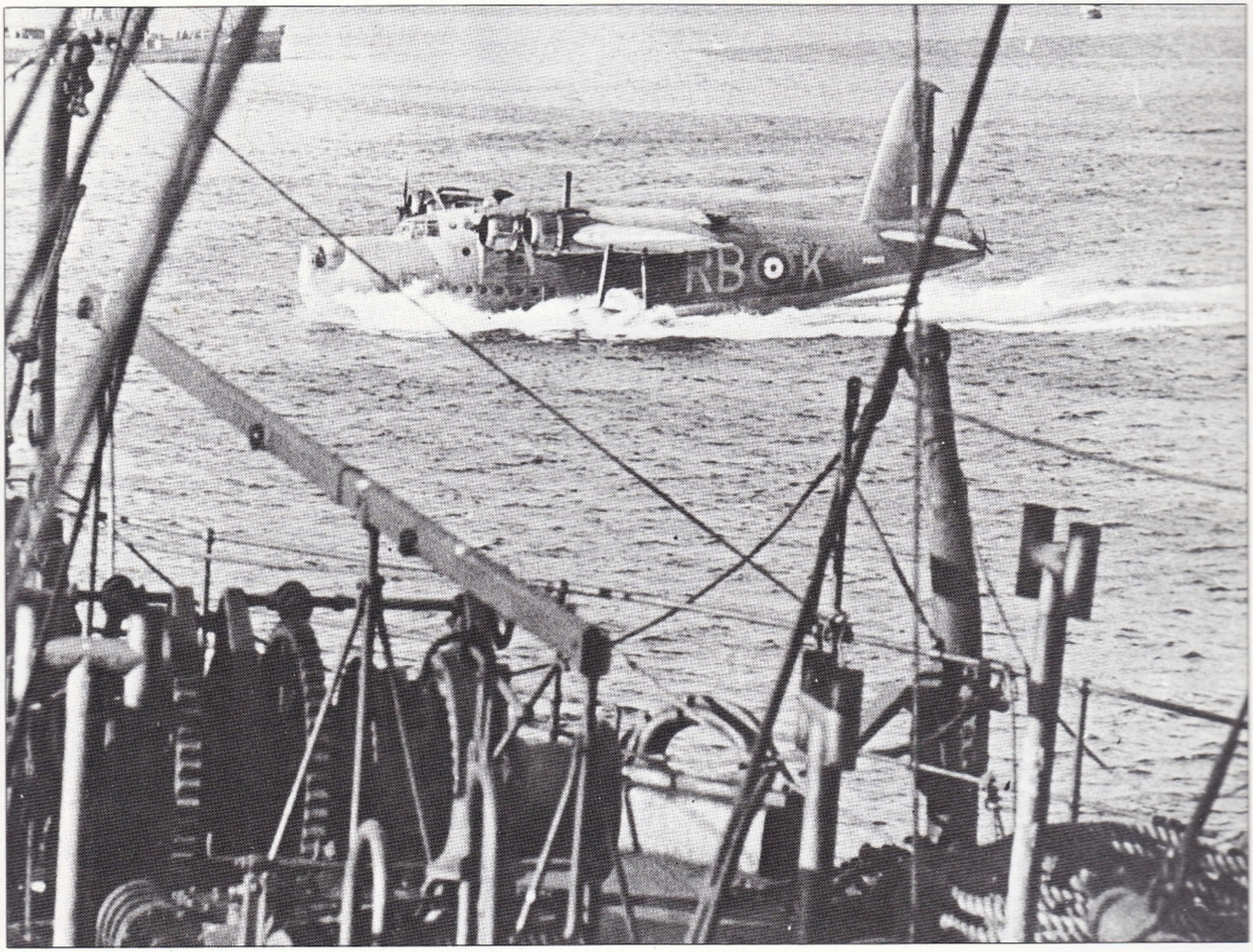
The Short Sunderland was one of the few RAF aircraft to be in front-line service throughout World War II, and indeed until the end of the war in Korea. Well armed and nimble for an aircraft of its size, the Sunderland was loved by its crews and respected by the Luftwaffe, who dubbed it the 'Flying Porcupine'.

Developed from the famous S.23 'Empire' flying-boat, the Short S.25 Sunderland was the RAF's biggest and most powerful aircraft at the start of World War II. Designed to a 1933 requirement, it first flew in October 1937, and needed remarkably little development before going into production the following year. The only real change was to add a four-gun tail turret and replace the nose gun, a giant 37-mm weapon, with a single-Browning nose turret; and this shifted the centre of gravity aft so that the wings had to be 'swept back' more than 4° in comparison with the original shape.

Going aboard for the first time was a revelation to the motley collection of skilled personnel who made up the first crews. Each crew comprised two pilots, who normally both sat in state on the spacious fully enclosed flight deck, a navigator who had a really big 'office' on the right (or, as it would have been called, starboard) side behind the pilots, a radio operator opposite on the left (port), and a flight engineer at the same high level but right at the rear, facing a mass of instrument panels in the heart of the top of the vast hull between the spars of the deep wing. In the nose was the bomb-aimer who normally manned the front turret but could lie face-down on his couch and, sighting through the outward-hinged nose window, aim whatever stores were to be dropped. In the rear were two gunner/observers, one in the tail turret with four Brownings and the other in the mid-upper position. In the Sunderland Mk I there was an open hatch on each side immediately aft of the wing, the upper deck being extended to the rear so that one or two crew could stand at the hatches, with the covers opened, and aim a Vickers 'K' drum-fed machine gun to each side. All subsequent marks had these positions replaced by a powered twin-gun dorsal turret.

Amidships at the lower level was the bomb room, where up to 907 kg (2,000 lb) of GP or A/S bombs, depth charges, mines or other ordn-

Cockpit of a Sunderland flying-boat. Note the Irvin fleece-lined jackets worn by the crew – vital clothing for the long patrols flown by these men in unpressurized hulls and unreliable heating systems. They were however something of a handicap if forced down into the water.



A Sunderland Mk I of No. 10 Sqn, Royal Australian Air Force, taxis out at Mount Batten, Plymouth, early in the war, prior to a sea patrol over the Western Approaches or rendezvous with an in-bound convoy.

A Short Sunderland Mk V pictured in the Far East just after the end of the war. RAF Far East Air Force Sunderlands were heavily used in the Korean war, one flying a doctor to the trapped frigate HMS Amethyst *during the so-called Yangtse incident.*

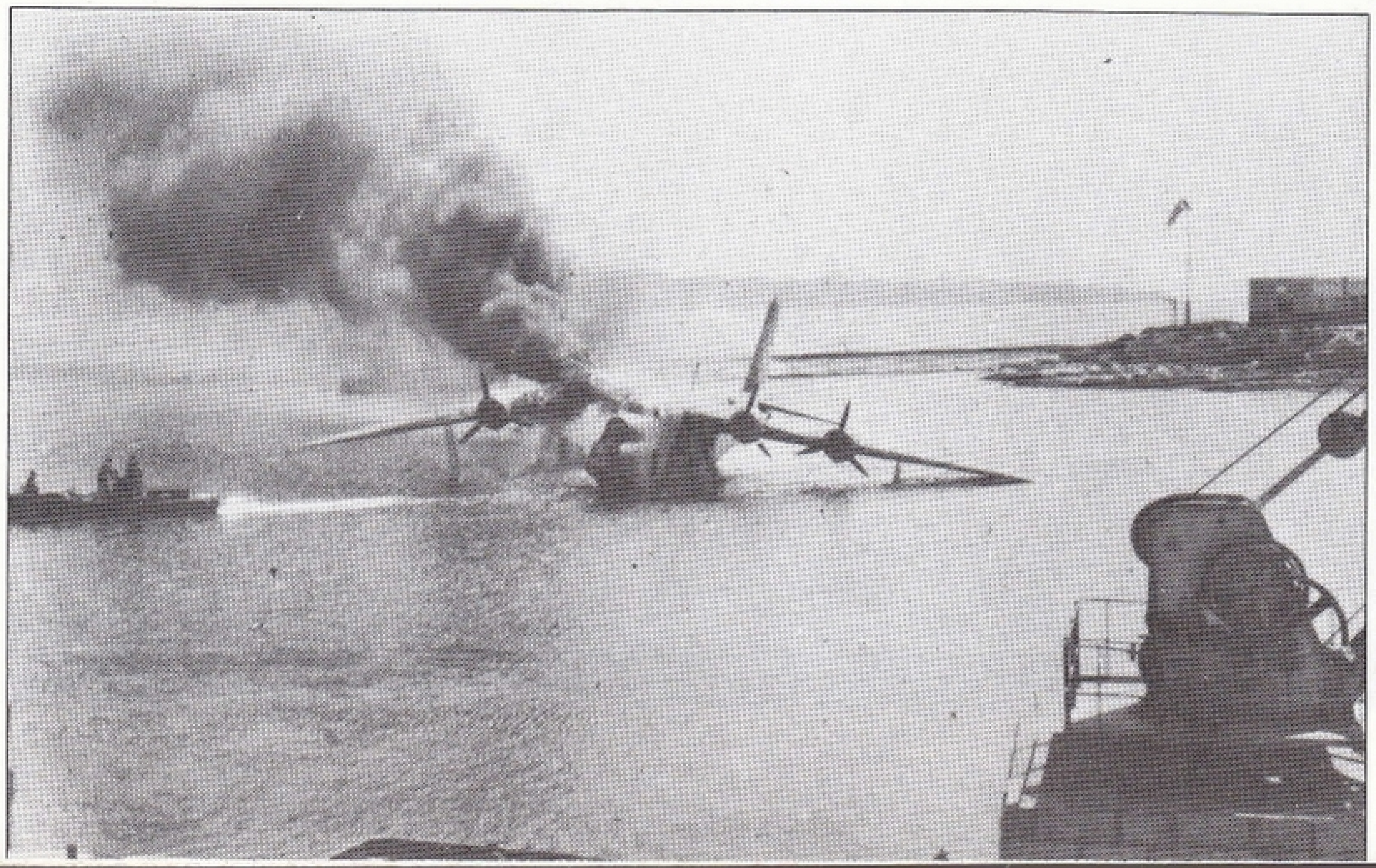
ance could be secured and, if required, raised by winch on to the bomb carriages. The left and right carriages were hung on overhead rails running athwartships. Opening the bomb doors in the sides of the hull under the wings allowed each carriage to be winched out on its rails under the wing until the entire load was clear of the hull. All around were incredibly spacious areas given over to workshops, spares stores, wardrooms and mooring areas (complete with what seemed a gigantic anchor) utterly unlike anything known elsewhere in the RAF. By day parts of the hull were gloomy, though this was not the case with the entrance hall, with its coat and baggage lockers and rifle racks, or with the wardrooms with their rows of portholes. By night it was pitch dark, yet rather like being in a cathedral. In the rear hull were giant shapes which might be made out to be great boxes of flares or spare propeller blades, while to the rear a lofty catwalk sloped up through a fabric draught screen and under the tailplane to the rear turret. On the upper level each station dimly glowed with phosphorescent instruments, and the Terry Anglepoise of the navigator cast a pool of yellow light.

Opening up the four Pegasus engines (each the same size but more than twice the power of the Jupiter from which it was derived), was unfailingly exciting. It was the only time the thunder of the engines was apparent, and the four vertical-scale rpm indicators would all leap to the take-off speed of 2,600 rpm. Purposefully, the great boat would surge ahead and soon get up 'on the step'; subsequent acceleration was faster and soon the water would be streaming back from the knife-edge at the rear of the keel as the great boat climbed away. At night nothing would be seen but the red and green wingtip lights reflected from the rain and mist, and the occasional sparks from the exhausts (which in most Sunderlands were all above the wing, so one saw only hefty sparks which appeared aft of the trailing edge). Strong pilots could throw the Sunderland around like a fighter, and though armament was really not powerful the Luftwaffe soon came to respect the Sunderland, calling it *fliegende Stachelschwein* (flying porcupine).

The first important operational mission came even before the Sunderland entered service. Thanks to the great Watson-Watt, the UK was fast completing the world's first chain of air-defence radars, round the east and south coasts. Could such radar be jammed? Boffin E.C. Williams from the secret team at Bawdsey Manor went aboard and supervised the loading of a powerful radio diathermy apparatus borrowed from an Ipswich hospital. The Sunderland cruised offshore while Williams pumped out jamming signals in the first ECM mission in history. Within days arrangements had been agreed for each radar to operate on four different frequencies to defeat such jamming.

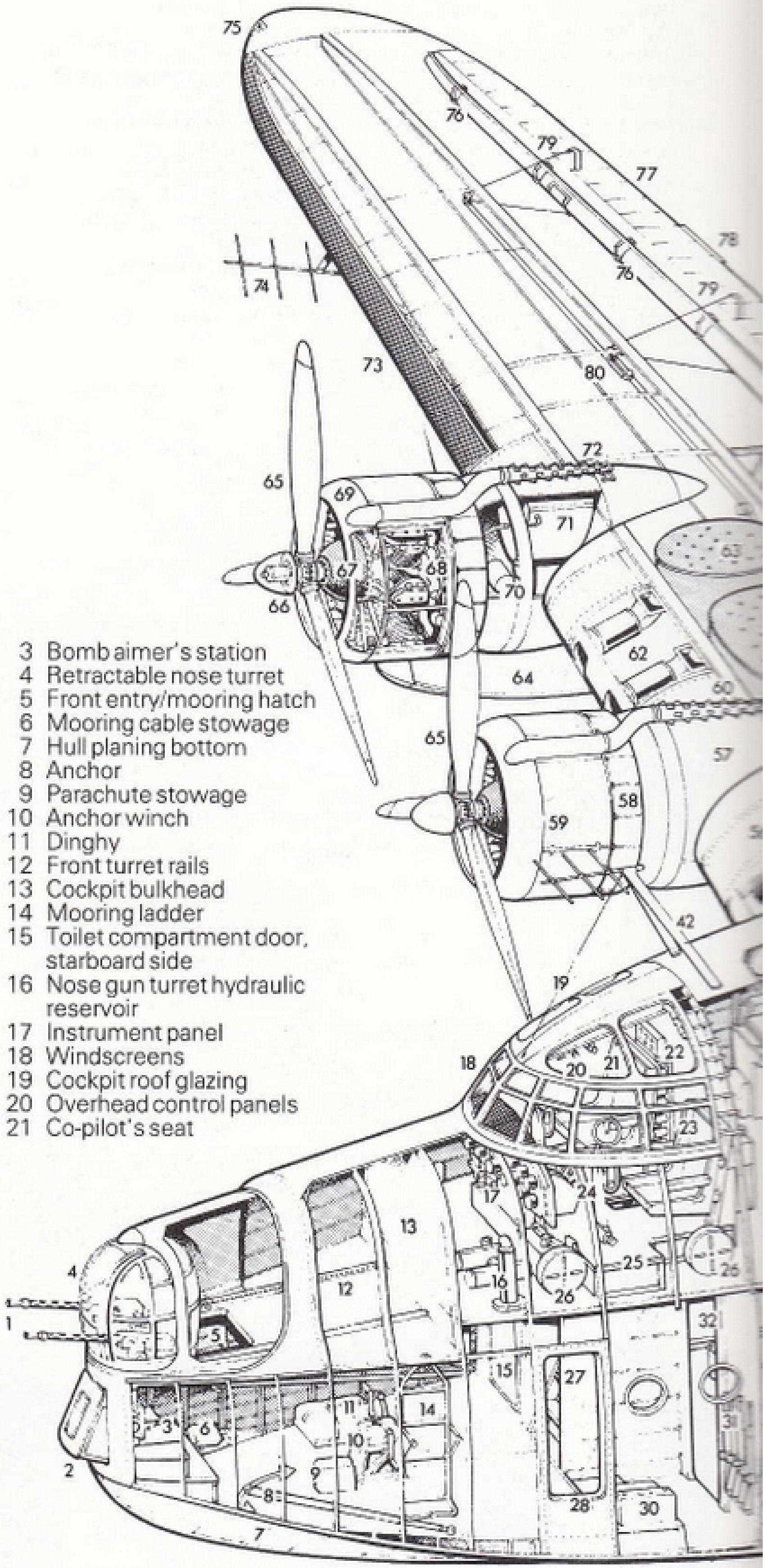
At the start of the war the Sunderlands were painted in marine camouflage, with bold tricolour stripes up the fin. Only two weeks into the war SS *Kensington Court* was torpedoed 113 km (70 miles) west of the Scillies. Two Sunderlands of No. 228 Squadron alighted in heavy seas and rescued the entire crew of 34 from overcrowded lifeboats; all were in hospital in Plymouth within an hour of the sinking. In those days U-boat sinking were rare, but on 31 January 1940 one of the same No. 228 Squadron machines caught *U-55* on the surface and the German crew scuttled their boat without a fight.

Casualties among aircraft based on Malta were particularly heavy, this Sunderland probably being hit during a strafing attack. Unlike damage inflicted on land-based aircraft, which was often repairable, flying-boats were usually totally written off, being much more vulnerable.



Short Sunderland Mk III cutaway drawing key

1 Twin Vickers 0.303-in (7.7-mm) machine-guns
2 Bomb aiming window, retractable
3 Bomb aimer's station
4 Retractable nose turret
5 Front entry/mooring hatch
6 Mooring cable stowage
7 Hull planing bottom
8 Anchor
9 Parachute stowage
10 Anchor winch
11 Dinghy
12 Front turret rails
13 Cockpit bulkhead
14 Mooring ladder
15 Toilet compartment door, starboard side
16 Nose gun turret hydraulic reservoir
17 Instrument panel
18 Windscreens
19 Cockpit roof glazing
20 Overhead control panels
21 Co-pilot's seat
22 Signal cartridge rack
23 Pilot's seat
24 Control column
25 Raised cockpit floor level
26 Autopilot controllers
27 Stairway between upper and lower decks
28 Front entry door
29 Fuselage chine member
30 Crew luggage locker
31 Rifle rack
32 Wardroom door
33 Planing bottom hull construction
34 Wardroom bunks
35 Window panels
36 Folding table
37 Upper deck floor level
38 Parachute stowage
39 Fire extinguisher
40 Navigator's seat
41 Chart table
42 Forward ASV radar aerial mast
43 Navigator's instrument panel



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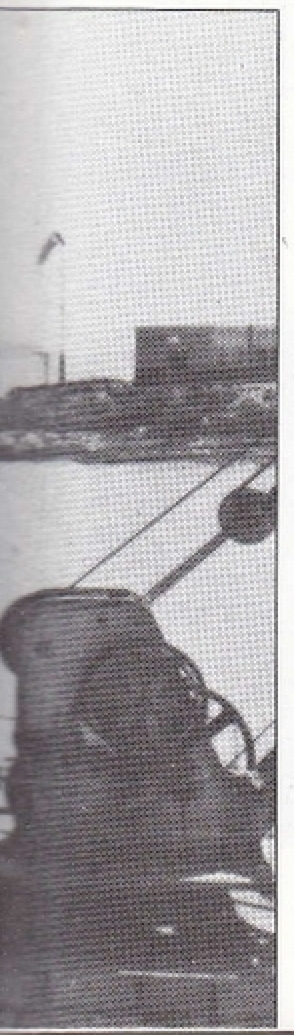

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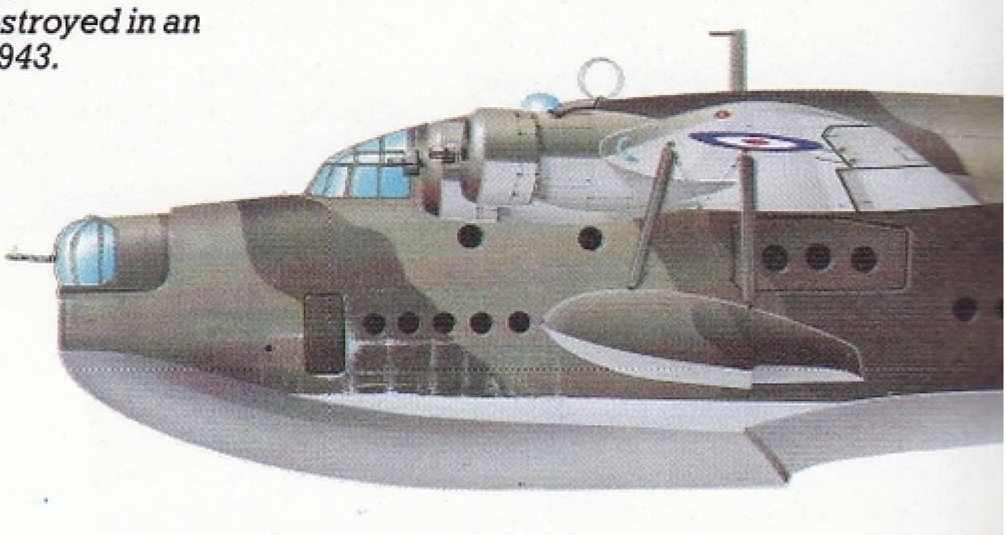
A veteran Sunderland Mk I serving with No. 230 Sqn in the Mediterranean; it had previously joined the squadron in the Far East at the beginning of the war, and continued to serve in the Mediterranean until destroyed in an accident on 1 January 1943.



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13 Cockpit bulkhead
14 Mooring ladder
15 Toilet compartment door, starboard side
16 Nose gun turret hydraulic reservoir
17 Instrument panel
18 Windscreens
19 Cockpit roof glazing
20 Overhead control panels
21 Co-pilot's seat
22 Signal cartridge rack
23 Pilot's seat
24 Control column
25 Raised cockpit floor level
26 Autopilot controllers
27 Stairway between upper and lower decks
28 Front entry door
29 Fuselage chine member
30 Crew luggage locker
31 Rifle rack
32 Wardroom door
33 Planing bottom hull construction
34 Wardroom bunks
35 Window panels
36 Folding table
37 Upper deck floor level
38 Parachute stowage
39 Fire extinguisher
40 Navigator's seat
41 Chart table
42 Forward ASV radar aerial mast
43 Navigator's instrument panel
44 Flight engineer's aft facing seat
45 Radio operator's station
46 Air intake duct
47 Wing/fuselage attachment main frames
48 Wing root rib cut-outs
49 Air conditioning plant
50 Engineer's control panels
51 Carburettor de-icing fluid tank
52 D/F loop aerial
53 Astrodome observation hatch
54 Auxiliary power unit
55 Forward inner fuel tank, 529-Imp gal (2405-litre) capacity
56 Fold-down, leading-edge maintenance platform
57 Starboard inner engine nacelle
58 Cowling air flaps
59 Detachable engine cowlings
60 Flame suppressor exhaust pipe
61 Forward inner fuel tank, 325-Imp gal (1477-litre) capacity
62 Oil coolers
63 Forward outer fuel tank, 132-Imp gal (600-litre) capacity
64 Starboard wing tip float
65 De Havilland three-bladed, constant speed propeller, 12ft 9in (3.89 m) diameter
66 Propeller hub pitch change mechanism
67 Engine reduction gearbox
68 Bristol Pegasus XVIII, nine cylinder radial engine, 1065 hp (794 kW)
69 Exhaust collector ring
70 Oil filter
71 Oil tank, 32-Imp gal (145-litre) capacity
72 Flame suppressor exhaust pipe
73 Leading edge de-icing
74 Starboard ASV aerial array
75 Starboard navigation light
76 Aileron hinges
77 Starboard aileron
78 Fixed tab
79 Aileron control horns
80 Control cable runs
81 Starboard 'Gouge-type' trailing-edge flap
82 Flap guide rails
83 Rear outer fuel tank, 147-Imp gal (668-litre) capacity
84 Flap jack
85 Rear inner fuel tank, 111-Imp gal (505-litre) capacity
86 Pitot tubes
87 Aerial mast
88 Observation window
89 Propeller de-icing fluid tank
90 Windscreen de-icing fluid tank
91 Bomb carriage traversing drive motor
92 Smoke floats and flame floats
93 Tailplane control cable runs
94 Reconnaissance flares
95 Turret fairing
96 Mid-upper gun turret, offset to starboard
97 Twin Browning 0.303-in (7.7-mm) machine guns
98 Fuselage skin plating
99 Spare propeller blade stowage
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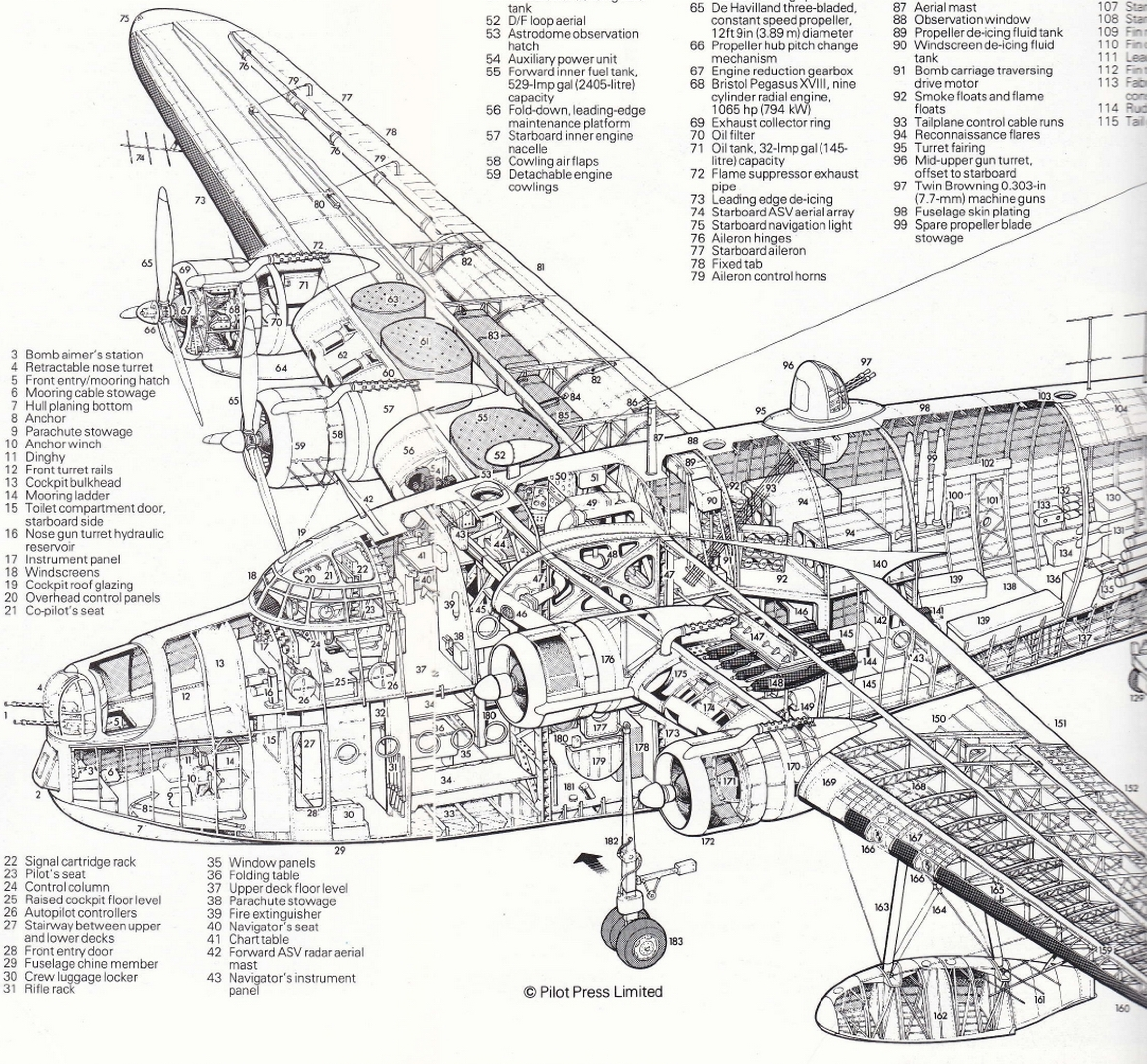

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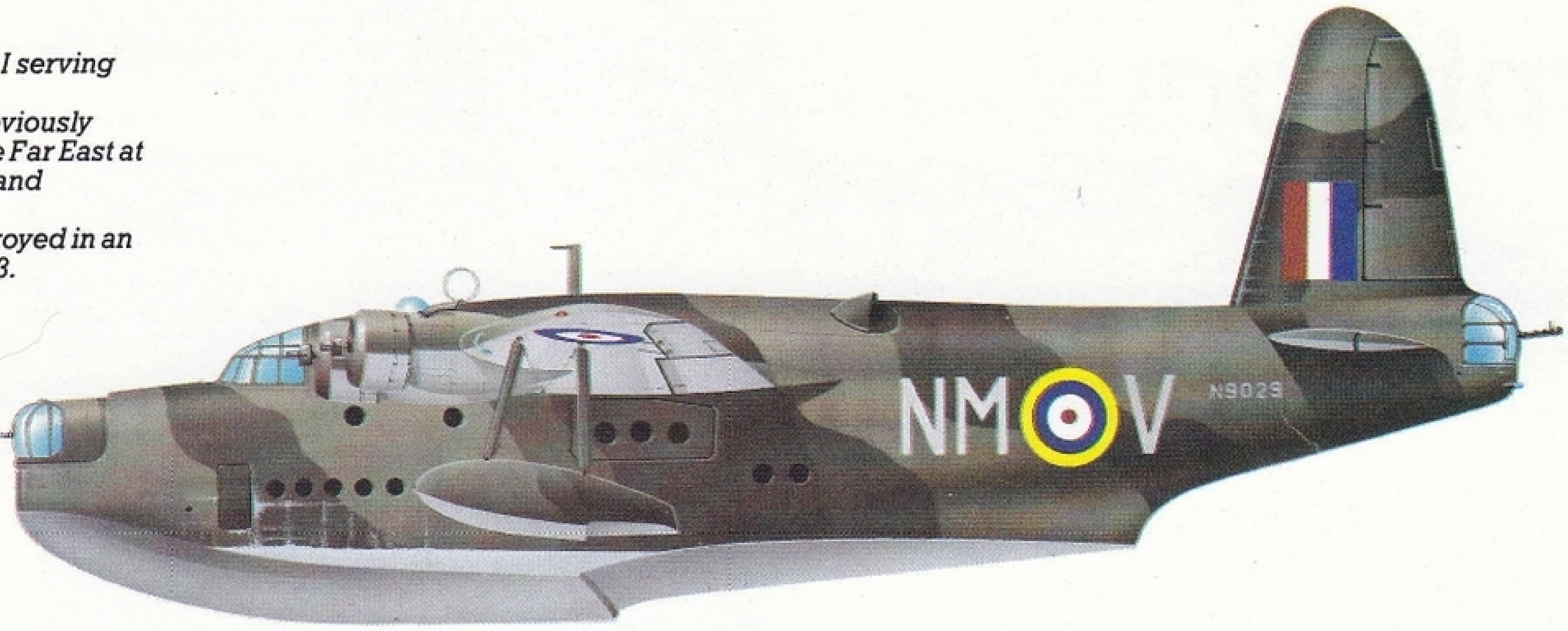
A veteran Sunderland Mk I serving with No. 230 Sqn in the Mediterranean; it had previously joined the squadron in the Far East at the beginning of the war, and continued to serve in the Mediterranean until destroyed in an accident on 1 January 1943.



44 Flight engineer's aft facing seat
45 Radio operator's station
46 Air intake duct
47 Wing/fuselage attachment main frames
48 Wing root rib cut-outs
49 Air conditioning plant
50 Engineer's control panels
51 Carburettor de-icing fluid tank
52 D/F loop aerial
53 Astrodome observation hatch
54 Auxiliary power unit
55 Forward inner fuel tank, 529-Imp gal (2405-litre) capacity
56 Fold-down, leading-edge maintenance platform
57 Starboard inner engine nacelle
58 Cowling air flaps
59 Detachable engine cowlings
60 Flame suppressor exhaust pipe
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62 Oil coolers
63 Forward outer fuel tank, 132-Imp gal (600-litre) capacity
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70 Oil filter
71 Oil tank, 32-Imp gal (145-litre) capacity
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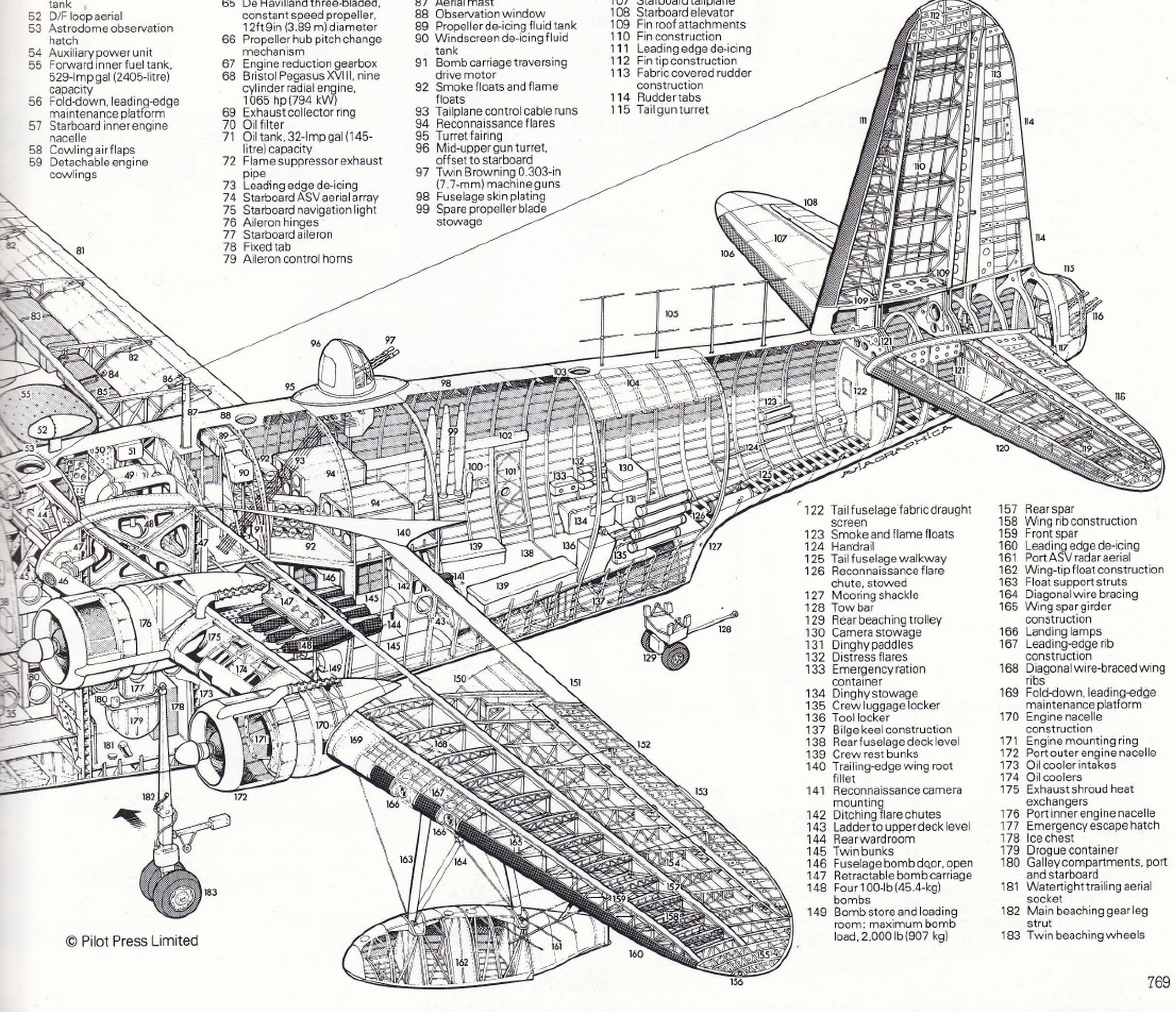
73 Leading edge de-icing
74 Starboard ASV aerial array
75 Starboard navigation light
76 Aileron hinges
77 Starboard aileron
78 Fixed tab
79 Aileron control horns
80 Control cable runs
81 Starboard 'Gouge-type' trailing-edge flap
82 Flap guide rails
83 Rear outer fuel tank, 147-Imp gal (668-litre) capacity
84 Flap jack
85 Rear inner fuel tank, 111-Imp gal (505-litre) capacity
86 Pitot tubes
87 Aerial mast
88 Observation window
89 Propeller de-icing fluid tank
90 Windscreen de-icing fluid tank
91 Bomb carriage traversing drive motor
92 Smoke floats and flame floats
93 Tailplane control cable runs
94 Reconnaissance flares
95 Turret fairing
96 Mid-upper gun turret, offset to starboard
97 Twin Browning 0.303-in (7.7-mm) machine guns
98 Fuselage skin plating
99 Spare propeller blade stowage
100 Fire extinguisher
101 Rear entry door
102 Maintenance platform stowage
103 Observation window
104 Fuselage frame and stringer construction
105 ASV Mk II-search radar aerial array
106 Leading edge de-icing
107 Starboard tailplane
108 Starboard elevator
109 Fin roof attachments
110 Fin construction
111 Leading edge de-icing
112 Fin tip construction
113 Fabric covered rudder construction
114 Rudder tabs
115 Tail gun turret
116 Four Browning 0.303-in (7.7-mm) machine-guns
117 Elevator tab
118 Fabric-covered elevator construction
119 Port tailplane construction
120 Leading edge de-icing
121 Tailplane spar fixing fuselage double frames



122 Tail fuselage fabric draught screen
123 Smoke and flame floats
124 Handrail
125 Tail fuselage walkway
126 Reconnaissance flare chute, stowed
127 Mooring shackle
128 Tow bar
129 Rear beaching trolley
130 Camera stowage
131 Dinghy paddles
132 Distress flares
133 Emergency ration container
134 Dinghy stowage
135 Crew luggage locker
136 Tool locker
137 Bilge keel construction
138 Rear fuselage deck level
139 Crew rest bunks
140 Trailing-edge wing root fillet
141 Reconnaissance camera mounting
142 Ditching flare chutes
143 Ladder to upper deck level
144 Rear wardroom
145 Twin bunks
146 Fuselage bomb door, open
147 Retractable bomb carriage
148 Four 100-lb (45.4-kg) bombs
149 Bomb store and loading room: maximum bomb load, 2,000 lb (907 kg)
150 Port flap shroud
151 Port 'Gouge-type' trailing edge flap
152 Fabric-covered aileron construction
153 Aileron tab, fixed
154 Trailing-edge lattice ribs
155 Wing to construction
156 Port navigation light
157 Rear spar
158 Wing rib construction
159 Front spar
160 Leading edge de-icing
161 Port ASV radar aerial
162 Wing-tip float construction
163 Float support struts
164 Diagonal wire bracing
165 Wing spar girder construction
166 Landing lamps
167 Leading-edge rib construction
168 Diagonal wire-braced wing ribs
169 Fold-down, leading-edge maintenance platform
170 Engine nacelle construction
171 Engine mounting ring
172 Port outer engine nacelle
173 Oil cooler intakes
174 Oil coolers
175 Exhaust shroud heat exchangers
176 Port inner engine nacelle
177 Emergency escape hatch
178 Ice chest
179 Drogue container
180 Galley compartments, port and starboard
181 Watertight trailing aerial socket
182 Main beaching gear leg strut
183 Twin beaching wheels

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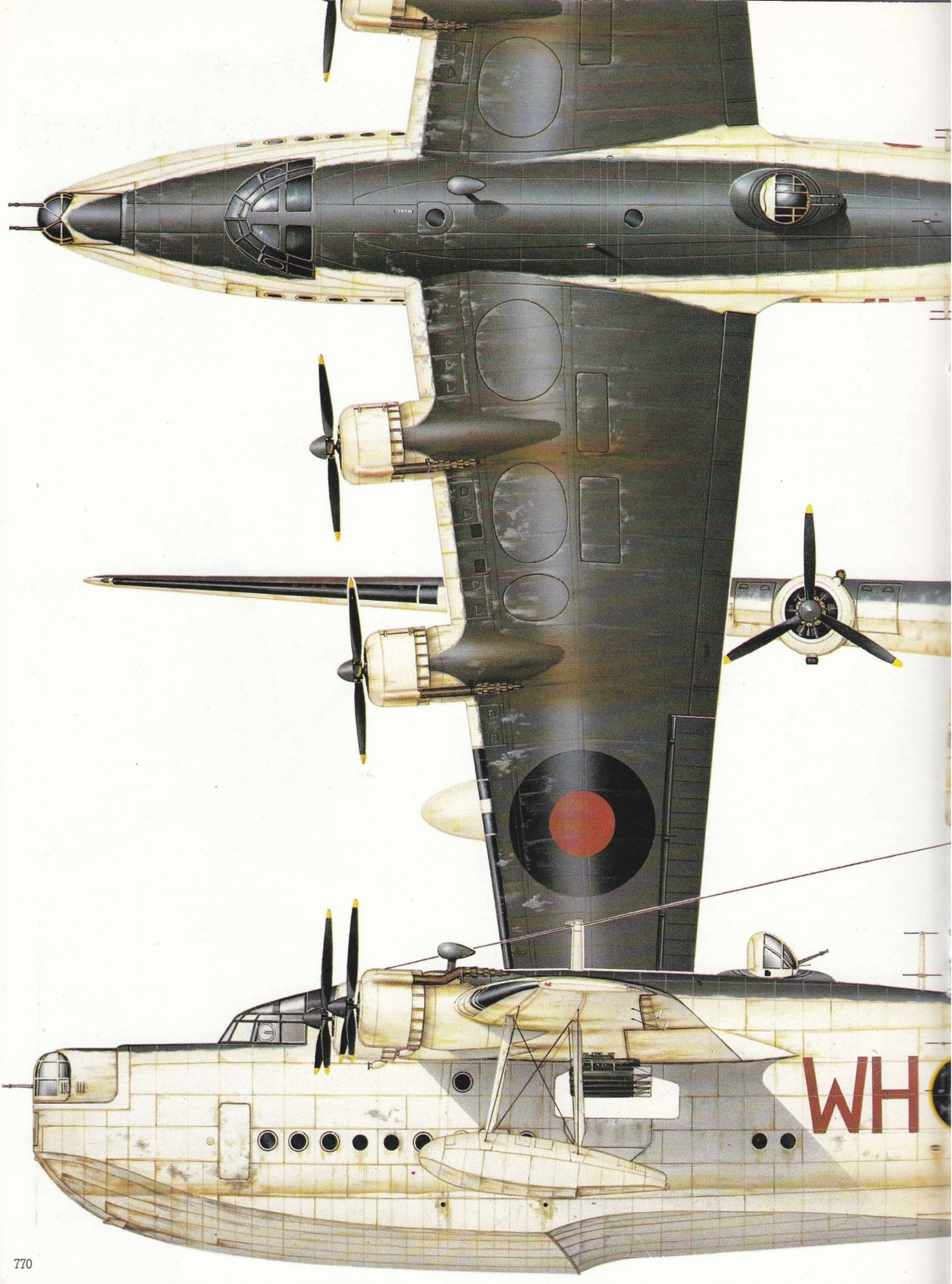
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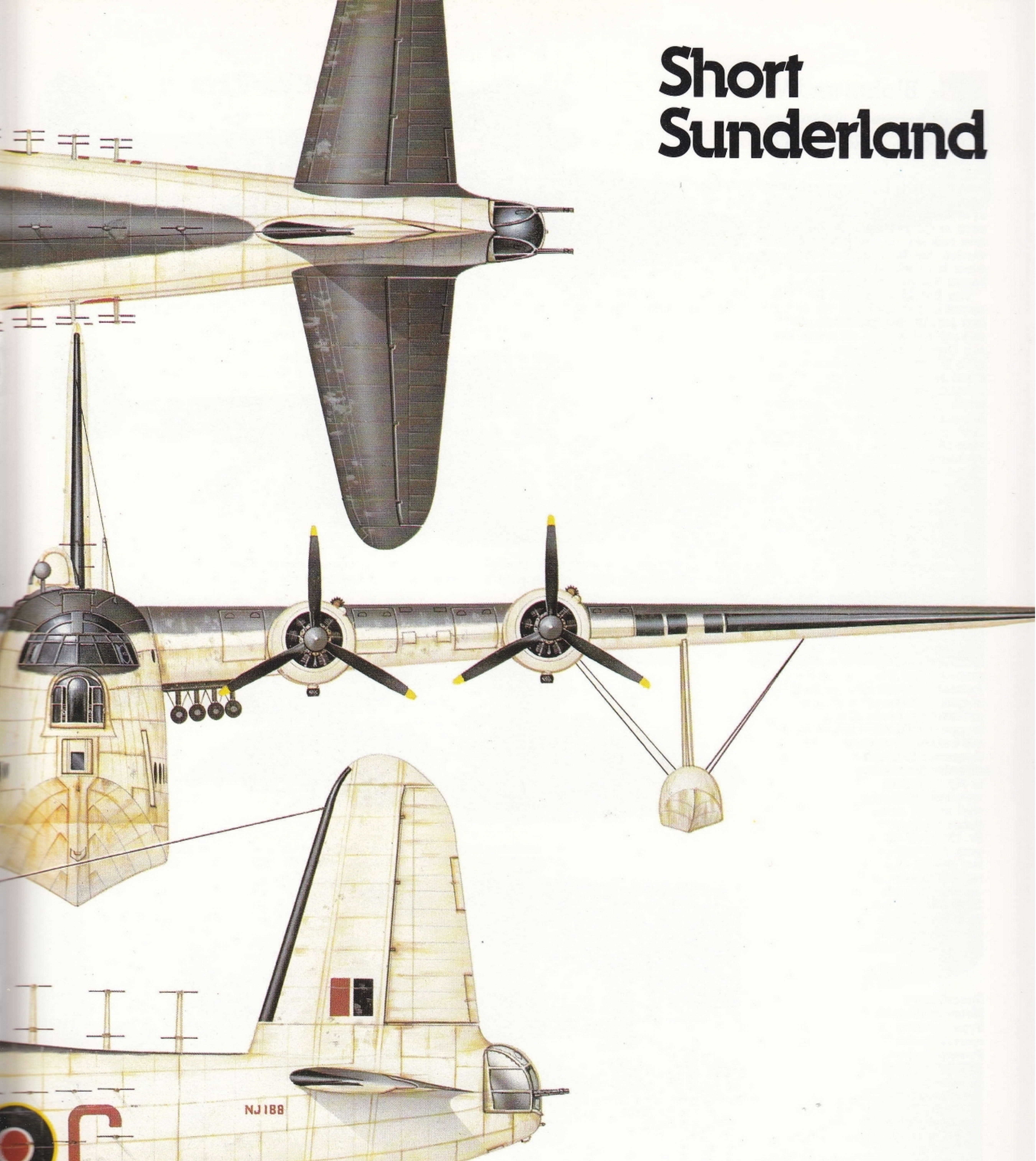
Short Sunderland



This Blackburn-built Sunderland Mk III is seen in the markings of No. 228 Sqn, operating in the Mediterranean. The Mk III was the most widely used of the wartime Sunderlands and was tough, reliable, and versatile. Sunderlands sank large numbers of enemy submarines and were sometimes able to beat off attacks by enemy fighters.

GERMANY

Blohm und Voss Bv 138

Originally conceived in 1934 as a very-long-range reconnaissance flying-boat, the **Blohm und Voss Ha 138 V1** prototype was first flown on 15 July 1937 as a shoulder gull-wing flying-boat with twin tail booms and three Jumo 205C engines. Directional stability and poor water handling characteristics in the prototype caused extensive redesign in the pre-production version, the **Bv 138A-0**, of which six were built with a considerably enlarged hull and an ungulled wing.

The first 25 production **Bv 138A-1** aircraft flew in April 1940, taking a limited part in the invasion of Norway, and entered general service in western France late that year. Considerable structural strengthening was found to be necessary and this was incorporated in the **Bv 138B-1**, 14 of which emerged from the production line in December, and seven more in 1941, powered by 880-hp (656-kW) Jumo 205D engines. A new turret was introduced mounting a single MG 151 20-mm cannon forward of the pilot's cockpit and another in the rear of the hull. The Bv 138Bs were very active in 1941, particularly those based in Norway after the sailing of the first North Cape convoys. Trouble had been experienced with the Bv 138B-1's engines and propellers, however, and an improved version, the **Bv 138C-1**, in which all the previous problems were eliminated, began appearing in March 1941; 227 of this version were built before production was terminated midway through 1943. In this model the centre Jumo 205D drove a four-blade propeller and provision was made for increased bombloads. The most successful exponents of the Bv 138C were probably the crews of Küstenfliegergruppe 406 based in northern Norway, this unit being responsible for much of the successful locating and shadowing of the North Cape convoys, particularly PQ 16 in April 1942. Some aircraft were equipped with FuG 200 Hohentwiel search radar for anti-shipping duties, while in the transport role the Bv 138 could carry up to 10 passengers. All versions could be fitted with two 500-kg (1,102-lb) thrust assisted take-off rockets, and a number of redundant Bv 138B-0s, redesignated **Bv 138MS**, were fitted with a large dural hoop energized by an auxiliary generator for magnetic mine clearance with the *Minensuchsgruppe*.

Specification

Blohm und Voss Bv 138C-1

Type: five-crew long-range maritime reconnaissance flying-boat

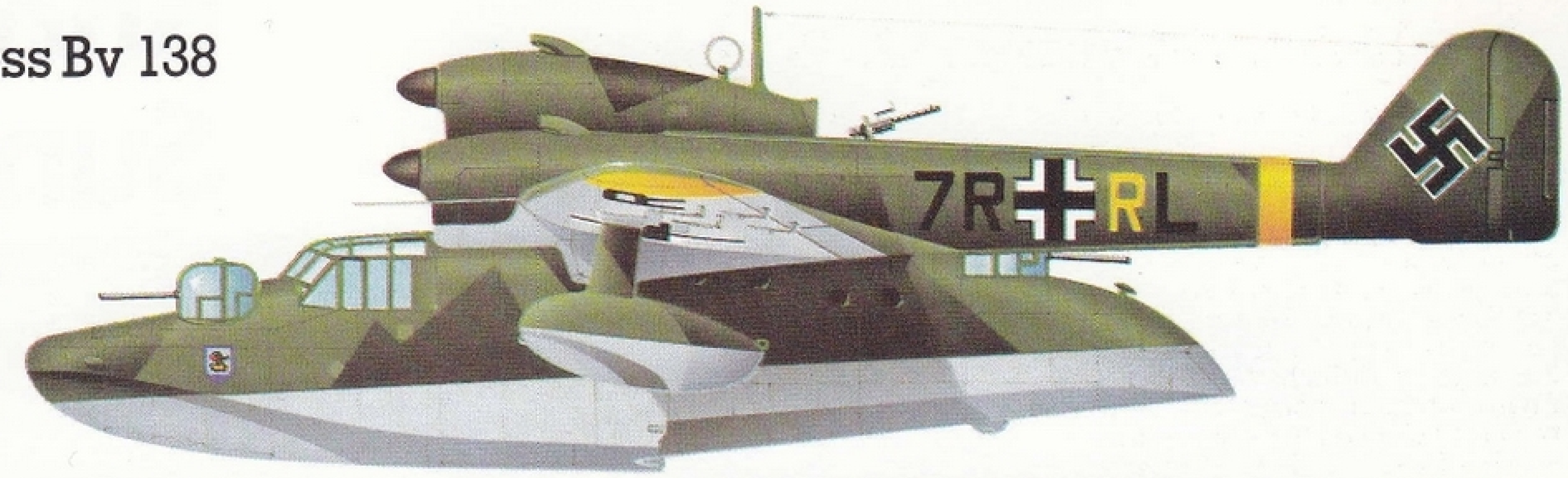
Powerplant: three 880-hp (656-kW) Junkers Jumo 205D 12-cylinder inline diesel engines

Performance: maximum speed 285 km/h (177 mph) at 3000 m (9,845 ft); normal service ceiling 5000 m (16,405 ft); maximum range 4300 km (2,672 miles)

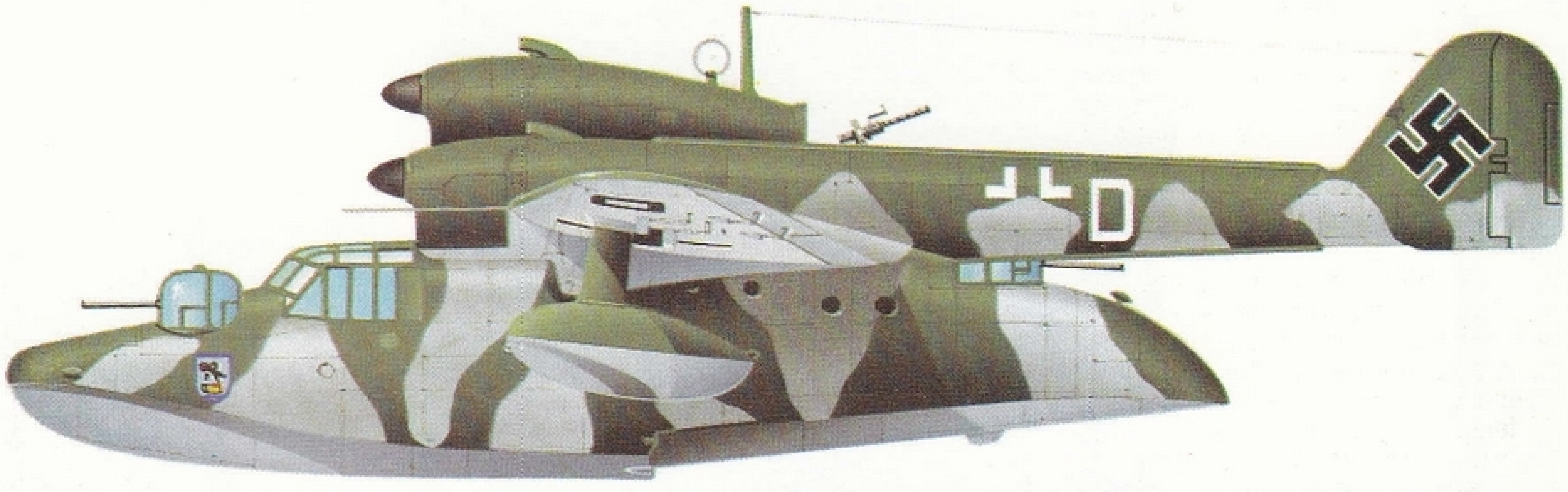
Weights: empty 11780 kg (25,970 lb); maximum take-off 17670 kg (38,995 lb)

Dimensions: span 26.94 m (88 ft 4 in); length 19.85 m (65 ft 1½ in); height 5.90 m (19 ft 4¼ in); wing area 112.00 m^2 (1,205.56 sq ft)

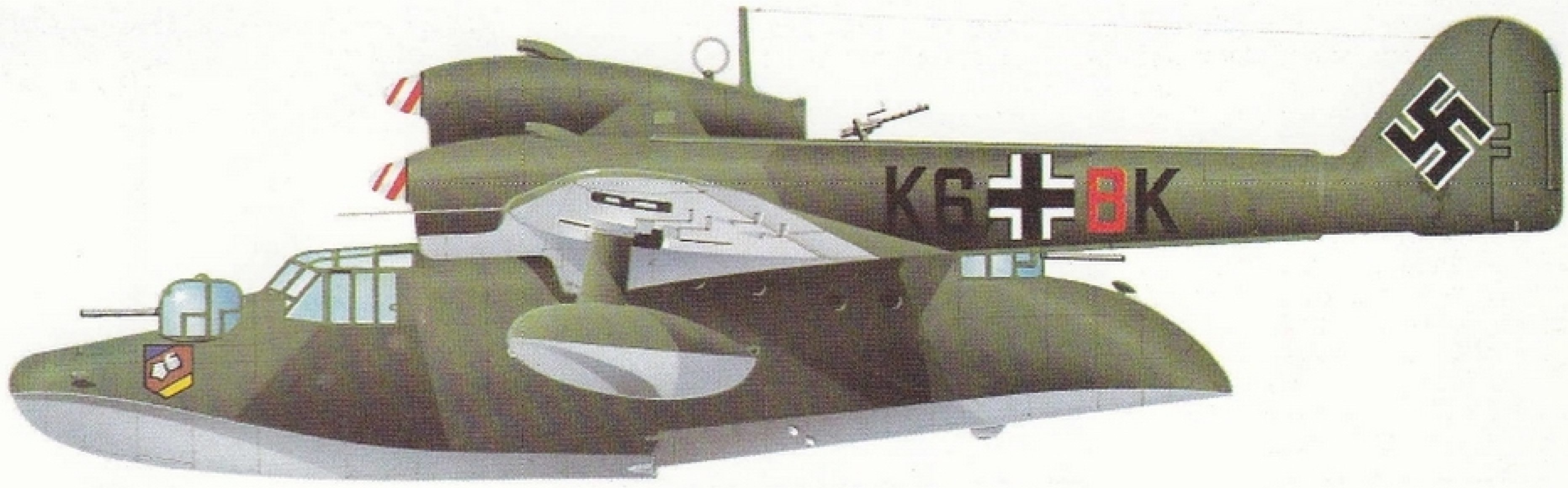
Armament: one 20-mm MG 151 cannon each in bow and stern turrets, one 13-mm (0.51-in) MG 131 machine-gun in open position aft of central engine, and one 7.92-mm (031-in) MG 15 gun in hatch of starboard side of hull, plus up to four 150-kg (331-lb) depth charges or equivalent weight of bombs on six racks



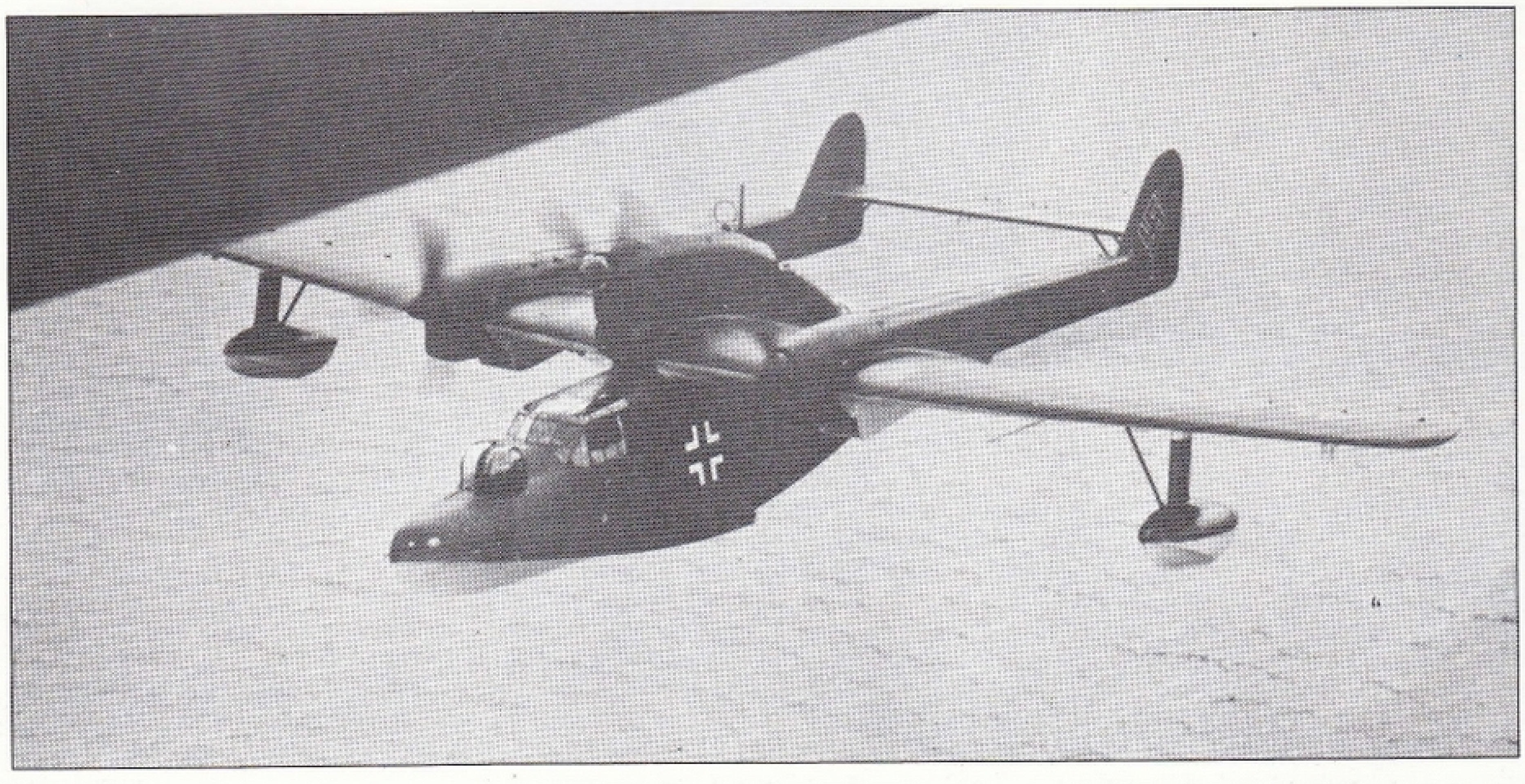
Wearing the customary splinter camouflage and yellow theatre bands, this Blohm und Voss Bv 138C-1 served with 3(F) Staffel, Seeaufklärungsgruppe 125, based at Constanza, Bulgaria, in April 1943 for service over the Black Sea.



Nicknamed the Flying Clog (der fliegende Holschuh) – reflected in its unit badge – this Bv 138C-1/U1 of 1.(F)/SAGr 130 was based at Trondheim, Norway, in April 1944 and sports a temporary winter camouflage.



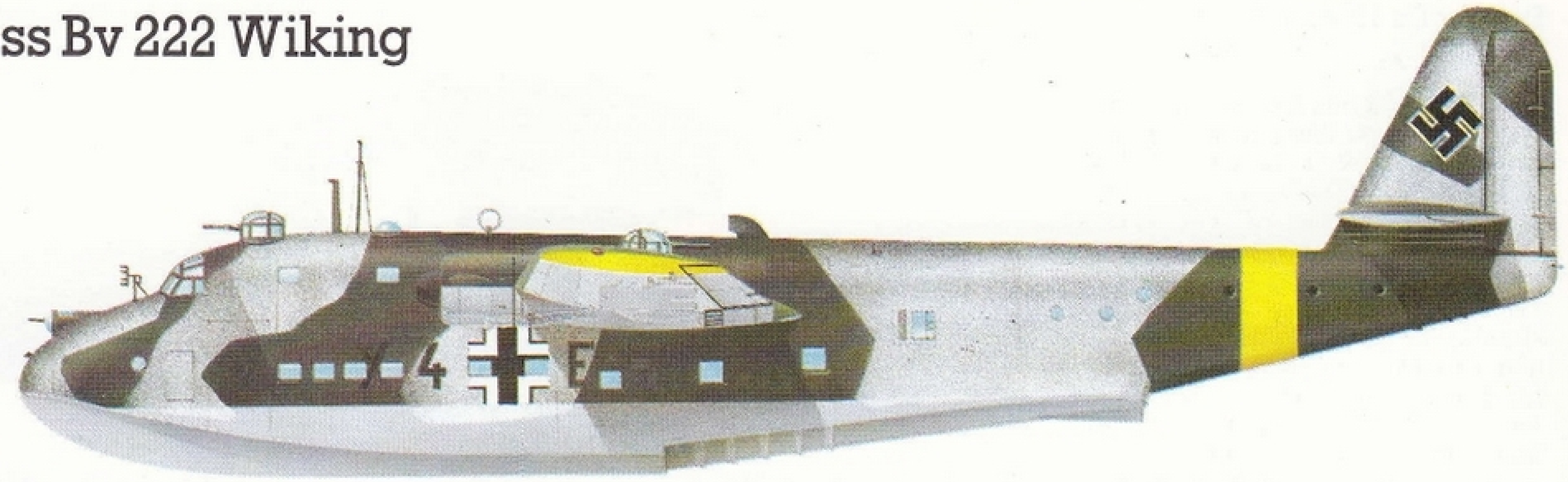
Blohm und Voss Bv 138 three-engine flying-boats replaced Dornier Do 18s of 6/MSGr 1 (previously Küstenfliegergruppe 506), this Bv 138MS being based at Grossenbrode in the last year of the war.



The curious three-engined Blohm und Voss Bv 138C-1 suffered lengthy development problems but eventually emerged as an effective aircraft. It was chiefly employed in the Baltic and against the North Cape convoys to the Soviet Union.

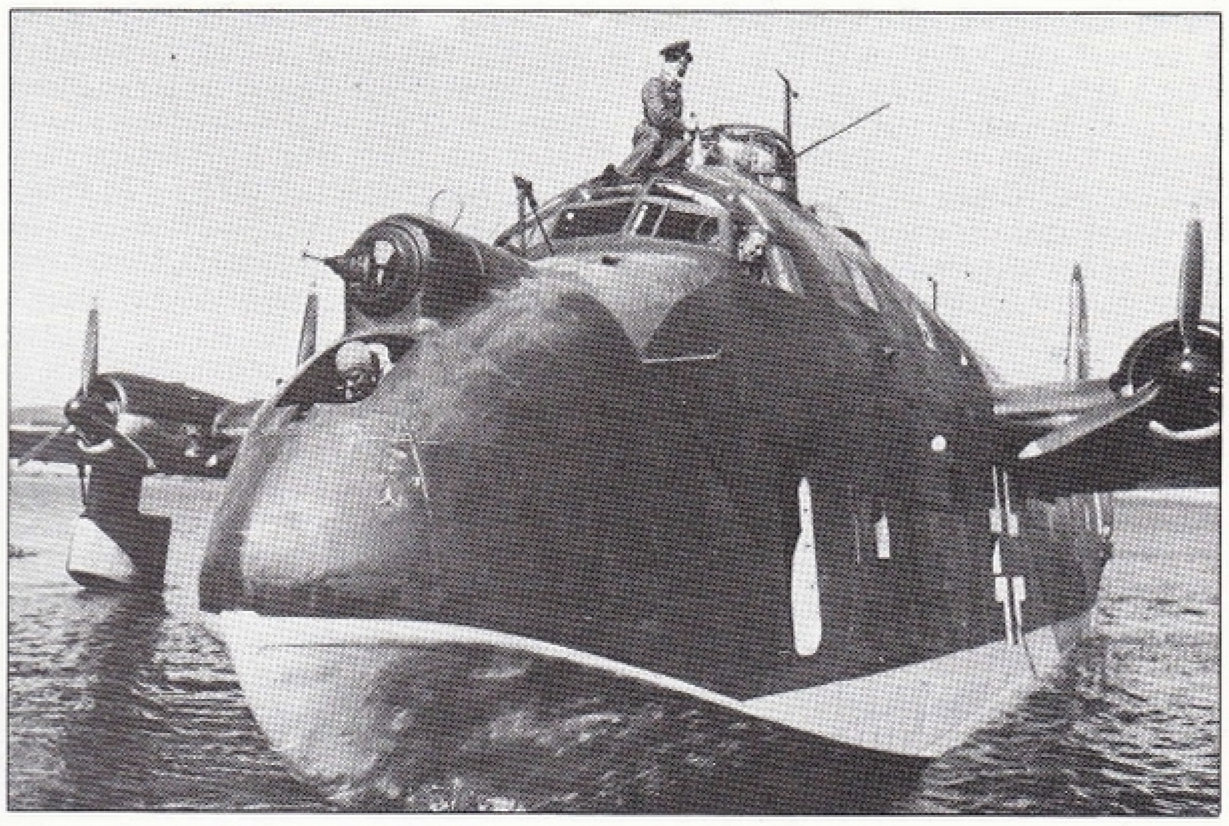
GERMANY

Blohm und Voss Bv 222 Wiking



The fifth Blohm und Voss Bv 222A-O was delivered to Lufttransportstaffel (See) 222 at Petsamo, Finland, in 1943 for transport duties over the northern sector of the Eastern Front. Note the over-wing gun turret.

Largest flying-boat to achieve production status during World War II, the six-engine **Blohm und Voss Bv 222 Wiking** was designed in 1936 to provide Deutsche Lufthansa with a 24-passenger airliner for the North and South Atlantic routes, but it was not until 7 September 1940 that the first prototype **Bv 222 V1** was first flown by Flugkapitän Helmut Wasa Rodig. Flying characteristics were pronounced good and the first operation for the Luftwaffe was flown by a civilian crew between Hamburg and Kirkenes, Norway, on 10 July 1941. Usually escorted by a pair of Messerschmitt Bf 110 fighters the Bv 222 V1, with six Bramo Fafnir radials, then started flying regular supply missions across the Mediterranean for German forces in North Africa. Several narrow escapes from Allied fighters emphasized the need for some defensive armament and the second and subsequent prototypes included a number of gun positions, while the Bv 222 V1 was fitted with seven single 7.92-mm (0.31-in) and 13-mm (0.51-in) machine-guns, and under each wing a gondola mounting a pair of the latter. The **Bv 222 V3** featured gun turrets on top of the wing between the outboard engines, each with a 20-mm cannon. By March 1943 a total of seven transport prototypes had been completed, all with armament variations; all served with Lufttransportstaffel See 222 (LTS See 222) in the Mediterranean, three being lost (two shot down by fighters and one sunk after striking a buoy while landing at Athens). The remaining aircraft, the **Bv 222 V2, Bv 222 V3, Bv 222 V4** and **Bv 222 V5**, were converted for maritime reconnaissance and served with Fliegerführer Atlantik, some with FuG 200 search radar; the Bv 222 V3 and Bv 222 V5 were destroyed at their moorings at Biscarosse by Allied fighters in June 1943, and another aircraft was shot down by an Avro Lancaster over the Bay of Biscay in the following October. The **Bv 222 V7** was the prototype of the production version, the **Bv 222C**, of which five examples were completed with six 1,000-hp (746-kW) Junkers Jumo 205D or 207C diesel inlines and a total armament of three 20-mm and five 13-mm (0.51-in) guns. Of these one was shot down by a British night-fighter near Biscarosse and another was hit by strafing Mustangs at Travemünde; the Bv 222 V2 was destroyed during the Allied reoccupation of Norway; two others were sunk by their crews at the end of the war, two were flown to the USA and one was ferried to the UK after the end of hostilities.



The considerable size of the Blohm und Voss Bv 222 six-engined flying-boat is evident from this photo of what is probably one of the prototypes. The struts on top and sides of the nose are the mountings for the FuG 200 search radar antennae.

Specification

Blohm und Voss Bv 222C-0

Type: 11/14-crew long-range reconnaissance and transport flying-boat

Powerplant: six 1,000-hp (746-kW) Junkers Jumo 207C 12-cylinder diesel inline engines

Performance: maximum speed 390 km/h (242 mph) at 5000 m (16,405 ft); initial climb rate 144 m (472 ft) per minute; service ceiling 7300 m (23,950 ft); range 6100 km (3,790 miles)

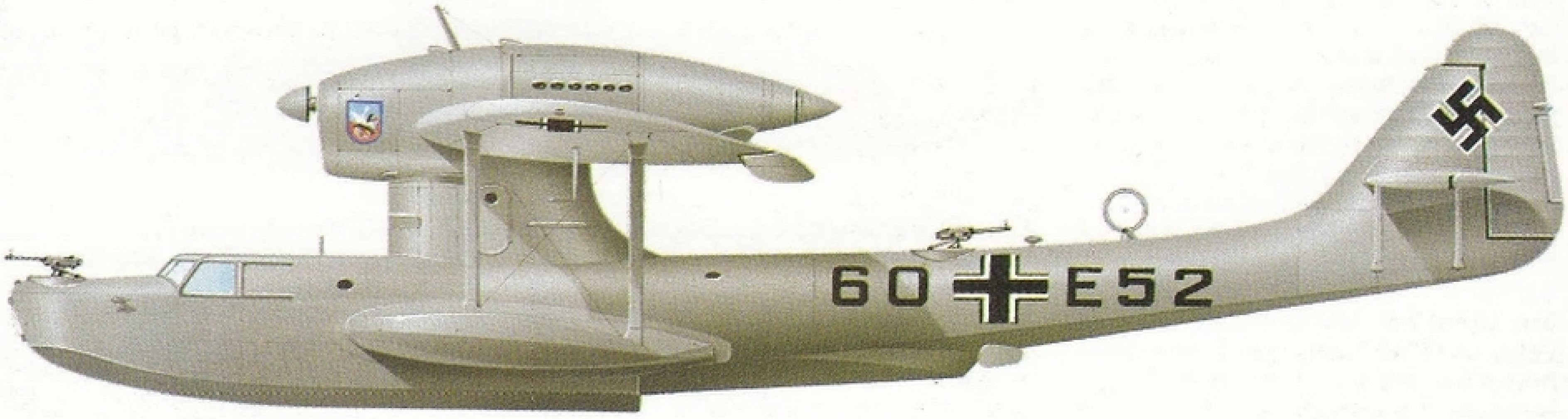
Weights: empty 30680 kg (67,367 lb); maximum take-off 50000 kg (108,026 lb)

Dimensions: span 46.00 m (150 ft 11 in); length 37.00 m (121 ft 4⅔ in); height 10.90 m (35 ft 9 in); wing area 255.00 m^2 (2,745 sq ft)

Armament: one 13-mm (0.51-in) machine-gun in bow position, one 20-mm cannon each in forward dorsal turret and in two overwing turrets, and four 13-mm (0.51-in) machine-guns in cabin windows; in the transport role the Bv 222 could carry about 92 fully-armed troops

GERMANY

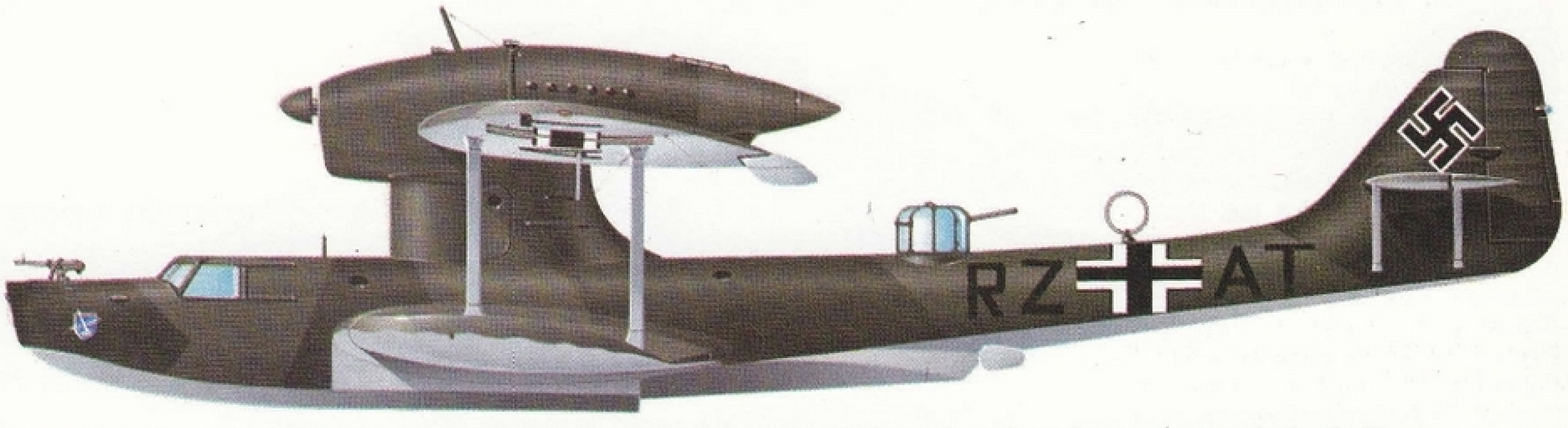
Dornier Do 18



Developed from the successful commercial mail-carrying flying-boats, the Dornier Do 18D entered Luftwaffe service in 1938. The aircraft shown served on 3./Küstenfliegergruppe 406 at List, Sylt, in August 1939. Note the open bow and midships gun positions.

Culmination of a series of successful pre-war flying-boats, which had begun as the Dornier Wal (whale) in the 1920s and progressed through the transatlantic mailplanes (the *Monsun, Zyklon, Zephir, Pampero* and *Aeolus*), the **Dornier Do 18D** was the first military adaptation of this attractive aeroplane. Powered by a pair of liquid-cooled 600-hp (448-kW) Jumo 205C diesel inline engines mounted in tandem in a nacelle on the high-mounted wing, the **Do 18D-1** and **Do 18D-2** started appearing in 1938 and were operational in September that year, it becoming customary to equip the second *Staffel* on each of the Luftwaffe's Küstenfliegergruppen (coastal patrol groups) with the Do 18 (eg 2./KüFlGr 306), the others usually flying Heinkel He 59 floatplanes. Armament of these aircraft comprised a single 7.92-mm (0.31-in) machine-gun in an open bow position and another in a midships position. In 1939 a more powerful version, the **Do 18G-1** with a pair of 880-hp (656-kW) Jumo 205Ds, was introduced with a 13-mm (0.51-in) MG 131 heavy machine-gun in the open bow position and a power-operated gun turret amidships mount-

A Dornier Do 18G is hoisted from the water onto its servicing trolley; the nose and midships armament is clearly visible, as are the unusual tandem engine arrangement and stabilizing sponsons.



The Dornier Do 18 entered service over the Mediterranean in 1941, performing air-sea rescue duties in the Malta-Sicily area. This Do 18G of 6. Seenotstaffel features the midships gun turret of the later service versions.

ing a single 20-mm MG 151 cannon. At the beginning of World War II Do 18Gs were equipping Küstenfliegergruppen 106, 406 and 906. Indeed it was an aircraft of 2./KüFlGr 106 that was the first German aircraft to fall to British guns on 26 September 1939; three Do 18s were shadowing British capital ships in the North Sea when they were attacked by nine Blackburn Skuas of No. 803 Squadron; one of the Dorniers was forced down and, after its crew had been taken aboard a British destroyer, it was sunk by gunfire. A total of 49 Do 18Gs was produced during 1940, but manufacture was terminated in September that year after fewer than 100 aircraft, including 70 Do 18Gs, had been completed. During the Battle of France six *Staffeln* were flying Do 18s, but in June 1940 most were withdrawn for conversion to the **Do 18H** dual-control trainer and the **Do 18N-1** air-sea rescue versions. During the Battle of Britain only 2./KüFlGr 106 was still fully operational with the Do 18, the majority of work being confined to air-sea rescue in the English Channel. However, 3./KüFlGr 906 returned to operations and continued to fly Do 18s over the North Sea until 1942, when the Do 18s were replaced by Blohm und Voss Bv 138s.

Specification
Dornier Do 18G-1
Type: four-crew medium-range maritime reconnaissance flying-boat
Powerplant: two 880-hp (656-kW) Junkers Jumo 205D 12-cylinder liquid-cooled diesel inline engines
Performance: maximum speed 266 km/h (165 mph) at 2000 m (6,560 ft); climb to 1000 m (3,280 ft) in 7 minutes 48 seconds; service ceiling 4200 m (13,800 ft); maximum range 3500 km (2,175 miles)
Weights: empty 5980 kg (13,180 lb); maximum take-off 10800 kg (23,810 lb)
Dimensions: span 23.70 m (77 ft 9¼ in); length 19.37 m (63 ft 7 in); height 5.32 m (17 ft 5½ in); wing area 98.00 m^2 (1,054.86 sq ft)
Armament: one 13-mm (0.51-in) MG 131 machine-gun in bow position and one 20-mm MG 151 cannon in power-operated turret amidships, plus provision for four 50-kg (110-lb) bombs

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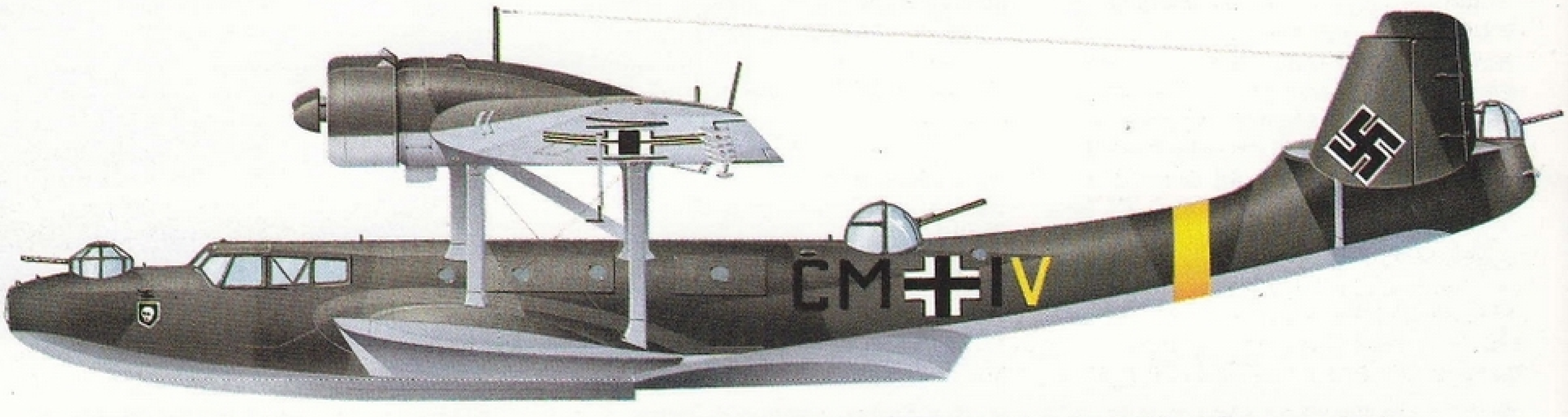
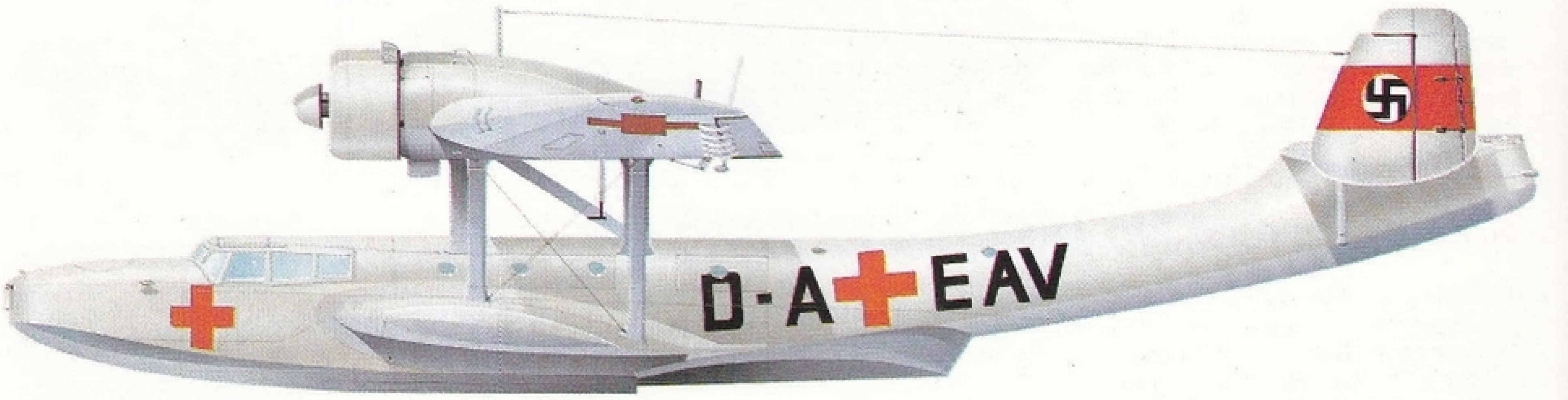
GERMANY

Dornier Do 24



A Dornier Do 24 wearing the skull emblem of the 8.Seenotstaffel, SBK XII operating in the Black Sea area during 1942. The Do 24 was especially suitable for the air-sea rescue role due to its unrivalled rough-water capabilities.



Contrary to wartime propaganda by the Allies, the Germans were scrupulous in omitting all armament from aircraft bearing Red Cross markings, as in this Dornier Do 24 flying-boat employed in casualty evacuation and air-sea rescue.

Another graceful Dornier flying-boat was the **Dornier Do 24**, originally designed in 1936 to meet a Royal Netherlands naval air service requirement for a flying-boat to operate in the East Indies. The Do 24 was a large parasol-wing monoplane with three engines on the wing and with *Flossentummeln* (sponsons) for stability on the water. The first flight by a prototype Do 24, powered by three 890-hp (664-kW) Wright R-1820 Cyclone radials, was made on 3 July 1937, this aircraft being delivered to The Netherlands that year and followed by the export of 11 similar production aircraft designated **Do 24K**. Licence production by Aviolanda/de Schelde accounted for 25 further aircraft before the invasion by Germany of 10 May 1940; many of these Dutch aircraft subsequently saw service in the Pacific theatre and six eventually found their way into the Royal Australian Air Force. Meanwhile the aircraft that had been partly completed in The Netherlands were transferred to Germany, and under the designation **Do 24N-1** were completed and issued to the Luftwaffe for air-sea rescue duties. Production in The Netherlands was resumed in 1941 under German supervision, 16 maritime reconnaissance/transport derivatives (the **Do 24T-1** and **Do 24T-2**) being completed that year. In 1942 the French seaplane manufacturer, Chantiers Aéro-Maritimes de la Seine (CAMS), then of course under German control, joined the Do 24T production programme and produced 46 examples to add to 154 from The Netherlands. Some of the French-built aircraft had not been completed at the time of the German retreat from France in 1944 and these were subsequently delivered to the French navy, whose Flottille 9F Tr was formed on 5 December that year to operate them.

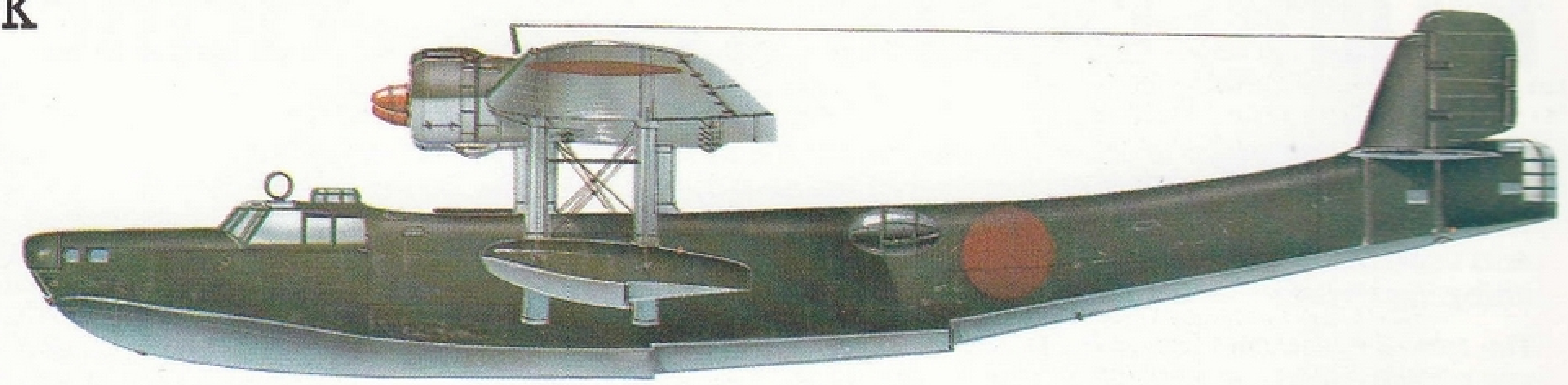
In Luftwaffe service the Do 24N served on three *Staffeln* of the Seenotgruppe (air-sea rescue group) at Berre, near Marseilles, and at Biscarosse. The 2. and 3./KG 200 (which flew Focke-Wulf Fw 200s on long distance maritime patrols) also flew a small number of Do 24Ns for rescue purposes, as did the small semi-autonomous ASR flights under command of the Seenotdientstführer.

Specification
Dornier Do 24T-1
Type: five/six-crew maritime reconnaissance and transport flying-boat
Powerplant: three 1,000-hp (746-kW) BMW/Bramo Fafnir 323R-2 nine-cylinder air-cooled radials
Performance: maximum speed 340 km/h (211 mph) at 2000 m (6,560 m); climb to 2000 m (6,560 ft) in 14 minutes 30 seconds; service ceiling 5900 m (19,355 ft); maximum range 4750 km (2,950 miles)
Weights: empty 9100 kg (20,062 lb); maximum take-off 18400 kg (40,564 lb)
Dimensions: span 27.00 m (87 ft 7 in); length 22.00 m (72 ft 4 in); height 5.75 m (18 ft 10¼ in); wing area 108.00 m^2 (1,162.5 sq ft)
Armament: one 7.92-mm (0.31-in) MG 15 machine-gun each in bow and tail positions and one 20-mm MG 151 cannon in midships turret, plus provision to carry up to 12 50-kg (110-lb) bombs

A Dornier Do 24, probably one of the Netherlands-built Do 24N-1s which were modified for service with the Luftwaffe and served with the Seenotstaffeln on air-sea rescue duties in the Mediterranean.

JAPAN

Kawanishi H6K



Owing much to current American and French flying-boat design of the mid-1930s, the large four-engine **Kawanishi Type 97** parasol monoplane flying-boat, which had first flown in July 1936, was Japan's only in-service long-range reconnaissance flying-boat when that nation went to war in December 1941, much effort having been dissipated in transport conversions and deliveries to Japan's commercial operators in the Pacific. The **H6K1** initial military version entered limited service with the Imperial Japanese Navy in 1938, and was followed by 10 **H6K2** flying-boats. The first major production version, the **H6K4** was powered by four Mitsubishsi Kinsei 43 radials and armed with four 7.7-mm (0.303-in) machine-guns in bow and midships positions and a 20-mm cannon in a tail turret, and was capable of carrying two 800-kg (1,764-lb) bombs or torpedoes, a total of 66 being in service at the time of Pearl Harbor; later aircraft were powered by Kinsei 46 engines. These 'boats were widely employed, although the initial heavy defeats inflicted on the Allies in the Pacific rendered maritime reconnaissance duties subordinate to the need for air transportation of Japanese troops during the swift conquests in the East Indies and elsewhere. A number of aircraft, designated **H6K4-L**, were therefore converted for transport duties and were each able to accommodate about 18 fully-armed troops; lacking armour and self-sealing fuel tanks, however, they were extremely vulnerable to fighter attacks and, after a number had been shot down, a new version entered production as the **H6K5** in August 1942; by that time the maritime reconnaissance version had been given the reporting codename **'Mavis'** by the Allies, the transport derivative being named **'Tillie'.** Powered by either Kinsei 51 or 53 radials, the H6K5 was intended to eliminate the shortcomings of the earlier versions, but although the open bow gun position was replaced by a single-gun turret immediately aft of the pilot's cockpit, the overall armament was not increased. Only 36 H6K5s were completed by 1943, when production gave place to the greatly superior H8K. H6Ks served with the 8th, 14th, 801st, Toko and Yokohama Kokutais, and some of the H6K5s were employed as naval staff transports throughout the Pacific in 1943. Eighteen aircraft served on the quasi-commercial courier services in South East Asia, a number of them being destroyed by Allied aircraft both in the air and at their moorings.

Specification

Kawanishi H6K5

Type: nine-crew maritime reconnaissance flying-boat

Powerplant: four 1,300-hp (970-kW) Mitsubishi Kinsei 53 14-cylinder air-cooled radials

Performance: maximum speed 385 km/h (239 mph) at 6000 m (19,685 ft); climb to 5000 m (16,405 ft) in 13 minutes 24 seconds; service ceiling 9600 m (31,495 ft); maximum range 6775 km (4,210 miles)

Weights: empty 12380 kg (27,293 lb); maximum take-off 23000 kg (50,705 lb)

Dimensions: span 40.00 m (131 ft 2¾ in); length 25.63 m (84 ft 0¾ in); height 6.27 m (20 ft 6¾ in); wing area 170.00 m^2 (1,829.86 sq ft)

Armament: four 7.7-mm (0.303-in) machine-guns in front and midships dorsal positions and two beam blisters, and one 20-mm cannon in tail, plus a bombload of up to 2000 kg (4,409 lb) or two 800-kg (1,764-lb) torpedoes

Final production version of the graceful Kawanishi Navy Type 97 Flying Boat Model 1 was the H6K5 which, though highly vulnerable to modern Allied fighters over the Pacific, remained in service up to the end of the war.

A Kawanishi H6K5 Navy Type 97 flying-boat of the Imperial Japanese Navy; its midships gun blisters are essentially similar to those of the American Catalina PBY. Note the weapon racks under the wing struts.

JAPAN

Kawanishi H8K

Although only 167 examples were produced, the large **Kawanishi H8K** was the most outstanding and advanced flying-boat to achieve production status during World War II. Designed to meet a requirement issued in 1938 for a four-engine maritime reconnaissance flying-boat superior in all respects to the British Short Sunderland, the **H8K1** prototype was first flown in January 1941, but proved initially to possess very poor water handling qualities. Extensive modifications were made and after successfully completing its service trials the aircraft was ordered into production as the **Navy Type 2 Flying-Boat Model 11**, powered by four 1,530-hp (1141-kW) Mitsubishsi Kasei 11 or 12 radials. Armament of these early aircraft comprised two 20-mm cannon and four 7.7-mm (0.303-in) machine-guns. With armour protection, self-sealing fuel tanks and a maximum speed of 433 km/h (269 mph), the new flying-boat indeed represented a considerable advance over the H6K. It carried out its first operational mission in March 1942 when two aircraft of the Yokohama Kokutai set out from Wotje Atoll in the Marshalls to bomb Oahu Island (Pearl Harbor), putting down at French Frigate Shoals to refuel from a submarine; however, arriving over the American base, the Japanese crews found heavy cloud and the raid was ineffective. Nevertheless as a long-range maritime reconnaissance aircraft, the H8K1 (codenamed **'Emily'** by the Allies) with its 7200-km (4,475-mile) range heavy armament and good performance proved a highly competent aircraft much respected by the Allies. The further-improved **H8K2**, with 1,850-hp (1380-kW) Kasei 22 radials and armament increased to five 20-mm cannon and four 7.7-mm (0.303-in) machine-guns, of which 112 were built between 1943 and 1945, was unquestionably the toughest opponent faced by the Allies in the Pacific. It was also equipped with ASV radar, being responsible for the sinking of at least three American submarines in the area north of the Philippines during the last 18 months of the war. Additional to the maritime reconnaissance version, 36 **H8K2-L** 'boats were built in the last two years of the war, these being equipped as naval staff and troop transports capable of accommodating either 29 staff passengers or 64 fully-armed troops. The progressively deteriorating war situation for Japan led to a run-down in production of flying-boats during 1945 in favour of fighters for home defence, and later versions of the H8K were accordingly abandoned. Nevertheless this excellent aircraft saw considerable service, being flown by the 14th, 801st, 851st, 1001st, 1021st, Takuma, Toko, Yokohama and Yokosuka Chinjufu Kokutais.

Specification

Kawanishi H8K2

Type: 10-crew maritime reconnaissance bomber flying-boat

Powerplant: four 1,850-hp (1380-kW) Mitsubishi Kasei 22 14-cylinder air-cooled radials

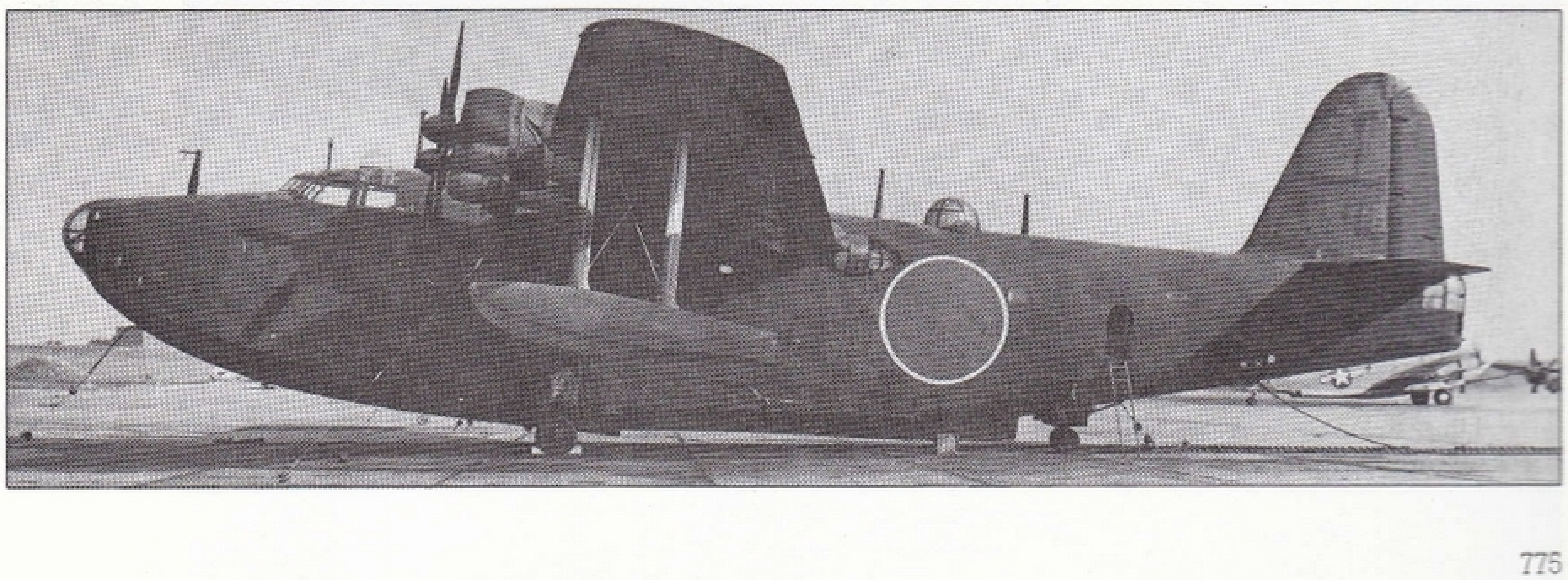
Performance: maximum speed 467 km/h (290 mph) at 5000 m (16,405 ft); climb to 5000 m (16,405 ft) in 10 minutes 12 seconds; service ceiling 8760 m (28,740 ft); maximum range 7180 km (4,460 miles)

Weights: empty 18380 kg (40,521 lb); maximum take-off 32500 kg (71,650 lb)

Dimensions: span 38.00 m (14 ft 8 in); length 28.13 m (92 ft 3½ in); height 9.15 m (30 ft 0 in); wing area 160.00 m^2 (1,722 sq ft)

Armament: single 20-mm cannon each in bow, dorsal and tail turrets and in two beam blisters, and four hand-held 7.7-mm (0.303-in) machine-guns in beam hatches, plus a bombload of up to 2000 kg (4,409 lb) or two 800-kg (1,764-lb) torpedoes

A captured Kawanishi H8K2 which had previously been flown by the 801st Kokutai over the Pacific and was later extensively evaluated by the US Navy. The aircraft's maximum range of 4,445 miles (7200 km) was impressive by any standards.



Flying-boats in the Pacific War

During the early years of the war in the Pacific, the strength of Japanese carrier air power restricted Allied use of slow and vulnerable flying-boats. As the Japanese were gradually overcome the Allies were less hampered in the use of flying-boats and used them for long-range maritime reconnaissance and increasingly for anti-shipping strikes.

The role of the flying-boat in the Pacific war was perhaps rather less significant than might have been expected when one considers the vast area of ocean to be patrolled and the predominantly maritime nature of the warfare. It was perhaps the very size of the theatre that limited the value of the long-range flying-boat until the gradual elimination of the Japanese carrier strength. However, in the relatively confined seas of the East Indies and numerous archipelagos that were to assume such strategic importance in the Pacific war the flying-boat came into its own in the maritime reconnaissance role. But it was extremely vulnerable both in its dispersed anchorage and when confronted by the large number of carrierborne fighters of the opposing fleets.

When Japan struck at Pearl Harbor the Imperial Japanese possessed about 100 Kawanishi H6Ks and a score of Yokosuka H5Ys distributed throughout the northern Pacific and at coastal bases in South East Asia. Deployed against possible Japanese aggression were about 70 Consolidated PBY Catalinas of varying vintages with 12 patrol squadrons of the US Navy, of which no fewer than five were concentrated at Hawaii; the Royal Netherlands naval air service in the East Indies possessed 24 Dornier Do 24Ks, the RAF's No. 205 Squadron had just received six Catalinas at Singapore, the RNZAF was operating a similar number of ancient ex-RAF Short Singapore boats at Fiji and the RAAF a few Catalinas in northern Australia.

For all their scattered deployment and vulnerability (almost half the Dutch Dorniers were destroyed in the first three weeks of the war and losses among the PBYs at Pearl Harbor were particularly heavy, one entire squadron being wiped out at its base at Ford Island), there were a number of memorable achievements by the big 'boats, the Australian Catalinas carrying out a successful long-range bombing raid on the Japanese base at Truk in the Caroline Islands on 15 January 1942. Apart from overseas patrolling by the American PBYs on the look-out for the wide-ranging Japanese fleets, the US Navy tended in the early days to use the flying-boats to act as 'navigators' while deploying fighter reinforcements throughout the Pacific.

Not until the big set-piece naval battles was the potential of the American PBY fully exploited; RAF Catalinas from Ceylon gave warning of the approach of Admiral Nagumo's carrier force in the Indian Ocean, a report which undoubtedly saved many ships (but not the carrier HMS *Hermes*) from destruction. In the preliminary stages of the great Battle of Midway 30 PBYs (based on Midway itself) were flown to cover the approaches at dawn every day and, on the critical 3 June 1942, one of their pilots sighted and shadowed the Japanese invasion fleet, and sent back constant position reports; the same night PBYs carried out a torpedo attack, hitting a troop transport. On the following day Catalina pilots sighted the all-important enemy carriers. In the Battle of the Solomons flying-boats of both sides were active, searching for the opposing fleets; once more the PBYs played a major part in locating Nagumo's carriers, and did so again in the Battle of Santa Cruz Islands.

By the time of the greatest carrier battle of them all, the Battle of the Marianas (the famous 'Turkey Shoot') of June 1944, the radar-equipped Martin PBM Mariner was in service alongside the PBY throughout the Pacific, and Saipan-based PBMs made the first contact with Admiral Ozawa's 1st Mobile Fleet.

The Japanese, on the other hand, were less fortunate in their use of flying-boats in the latter half of the war, largely as a result of the depredations of American long-range fighters, but also of their lack of reliable ASV radar which was in everyday use by almost every Allied maritime reconnaissance aircraft the world over. The superb Kawanishi H8K 'boat arrived too late to make any real impact and tended to be wasted in second-line duties such as naval transport roles.

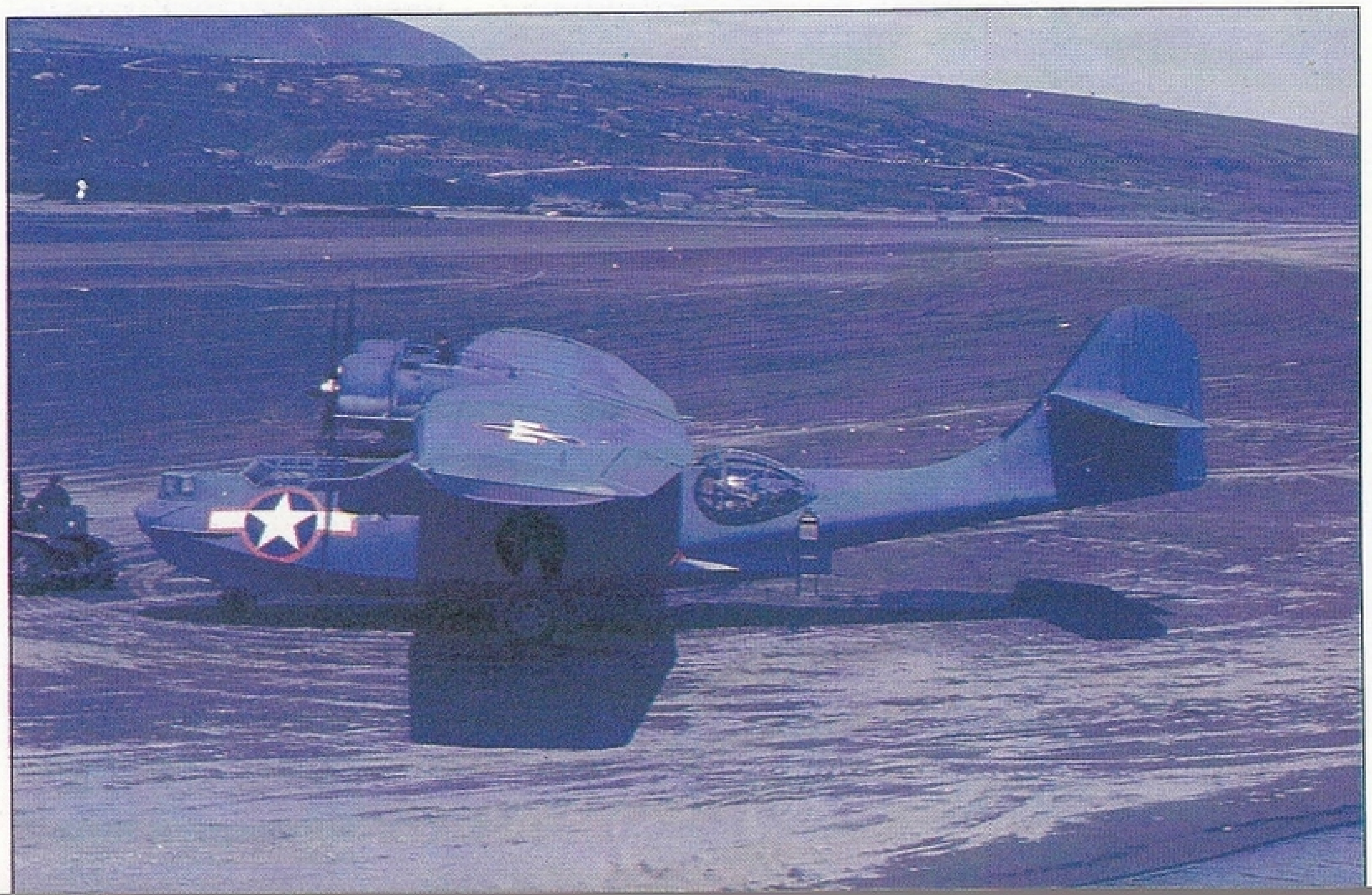
After the disastrous losses inflicted among American merchant shipping in the Western Atlantic and in the Caribbean by long-range U-boats shortly after the USA's entry into the war, both the USAAF and the US Navy steadily increased the number of maritime reconnaissance and patrol squadrons whose job it was to guard against the submarine menace. By 1943 these patrols gave effective over-sea cover up to about 1300 km (800 miles) off the North American coast, while similar cover was already afforded by Coastal Command on the eastern side of the North Atlantic. This still left a substantial gap in mid-ocean that could only be covered by aircraft (of very limited range) embarked in small aircraft-carriers which occasionally accompanied the larger convoys themselves. In the South Atlantic, by use of Ascension Island and bases in Brazil, almost the whole width of ocean between Africa and South America was within range of patrol aircraft.

U-boat packs

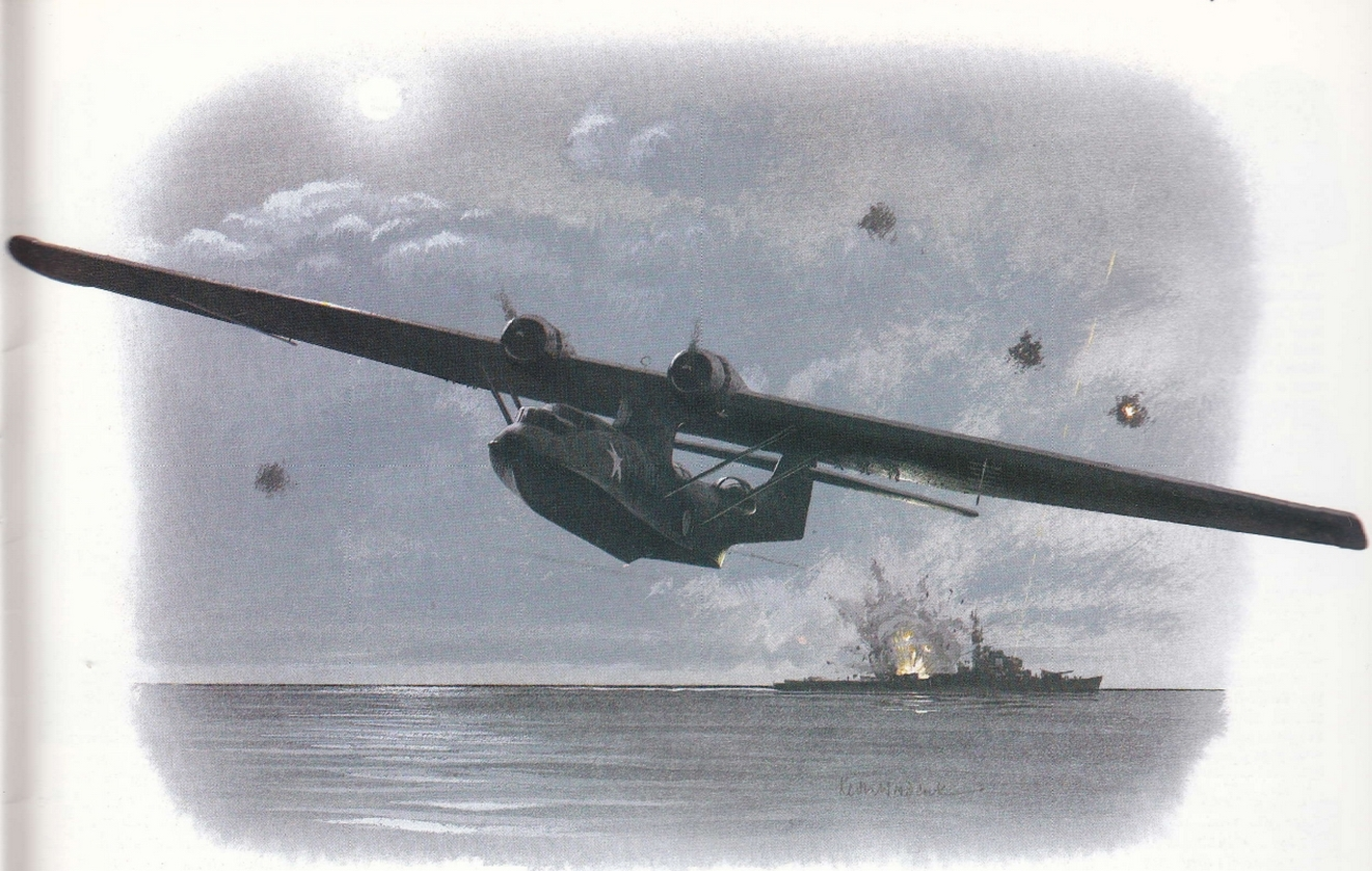
The increasing success by all the Allied anti-submarine forces brought about a considerable change in German submarine tactics during the last two years of the war, not least of which was the use of U-boat 'packs'. These would shadow the convoys until out of range of shore-based aircraft when they would strike in unison, often with catastrophic results for the merchant ships. As regards the work of the flying-boats this had two significant consequences, the second brought about by the first. The first involved much greater efforts being made against the U-boats 'in transit' to and from their bases on the Biscay coast of France; the second came about when the U-boats themselves were given more guns with which to defend themselves if attacked by aircraft. As remarked above, there were now to be numerous instances in which U-boat commanders preferred to remain surfaced in order to fight it out with an attacking aircraft. The two occasions on which Catalina pilots were awarded the Victoria Cross serve well to illustrate the hazards inolved.

On 24 June 1944 a Canadian Catalina pilot, flight Lieutenant D.E. Hornell, sighted and attacked a surfaced U-boat in the North Atlantic. As one of the flying-boat's front machine-guns jammed, the submarine's multiple cannon opened up and hit one of the Catalina's engines and set the wing fuel tanks on fire. Struggling to keep control of his crippled and blazing aircraft, Hornell managed to make a low-level attack, straddling and sinking the U-boat with his depth charges. When the burning engine fell off, the pilot had no alternative but to ditch and, despite two wounded members, managed to get his crew into the one undamaged dinghy. Battered by icy seas, gale force winds and 6-m (20-ft) waves, all but one of the seven crewmen survived more than 20 hours in the dinghy before being picked up by a naval rescue launch; Hornell, who had lost consciousness in the final hours, died three hours later. His Victoria Cross was awarded posthumously.

The Scotsman Flying Officer J.A. Cruickshank of No. 210 Squadron also attacked a surfaced U-boat in the North Atlantic less than a



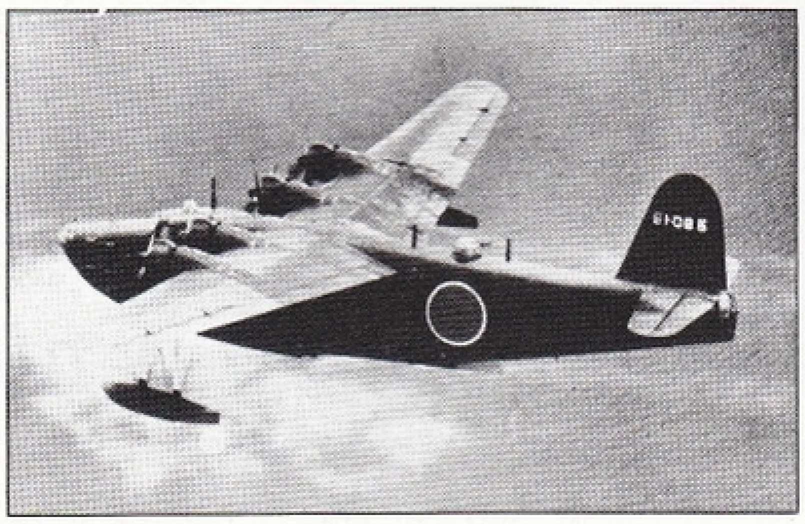
A view of an air base in the Aleutians showing an ASV-equipped Consolidated PBY-5 amphibian, the main maritime patrol aircraft serving with the US Navy in the Pacific during 1942.



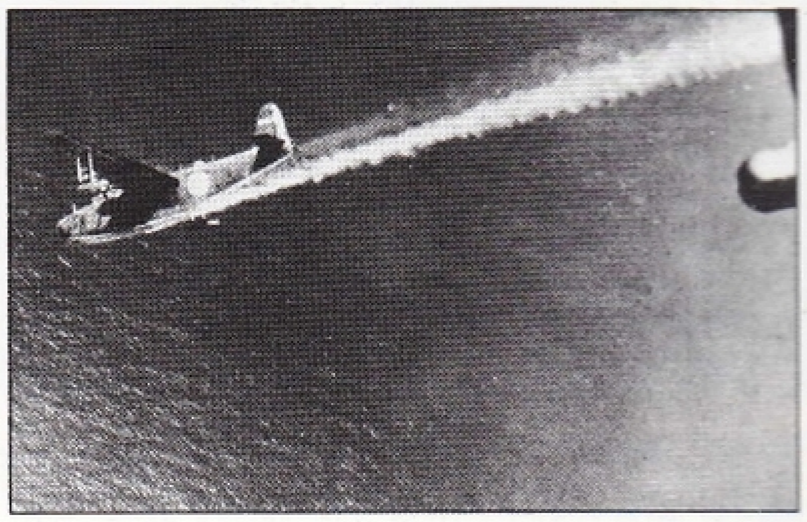
PBY Catalinas were most effective when used at night. With inadequate defensive armament and performance for daytime operations, special 'Black Cat' squadrons were formed for nocturnal 'Search and Strike' missions. Equipped with radar and armed with bombs or torpedoes, the long-ranging Catalinas roamed over the Pacific theatre stalking Japanese ships and attacking their bases. The first dedicated night-intruder squadron was VP-12, but the success of these original 'Black Cats' soon led to the formation of further squadrons.

month later. Again the submarine fought back with its 37-mm and 20-mm guns, but in the first attack the Catalina's depth charges failed to release, the navigator/bomb-aimer being killed. Despite being wounded in 72 places, including the lungs, Cruickshank turned for a second attack and released the weapons himself, sinking the enemy submarine. Four more crew members were severely wounded by shell bursts which started a fierce fire inside the flying-boat. Refusing morphia lest he should lose consciousness, Cruickshank managed to retain control while the crew extinguished the fire; only then did he allow himself to be carried aft as the wounded second pilot took over control for the 800-km (500-mile) flight back to Sullom Voe; however, Cruickshank remained in command and supervised the landing and beaching of the flying-boat. As the boat ground to a stop on the shingle Cruickshank, who had lost more than four pints of blood, collapsed; after many weeks in hospital he recovered, to be presented with the highest award for valour.

Such was the nature of the flying-boat's war.



Above: Pictured here, moments before being shot down, the Kawanishi H8K2 flying-boat carried a defensive armament of five 20 mm cannon and five machine-guns. It was probably the best flying-boat to be produced by any nation during World War II.



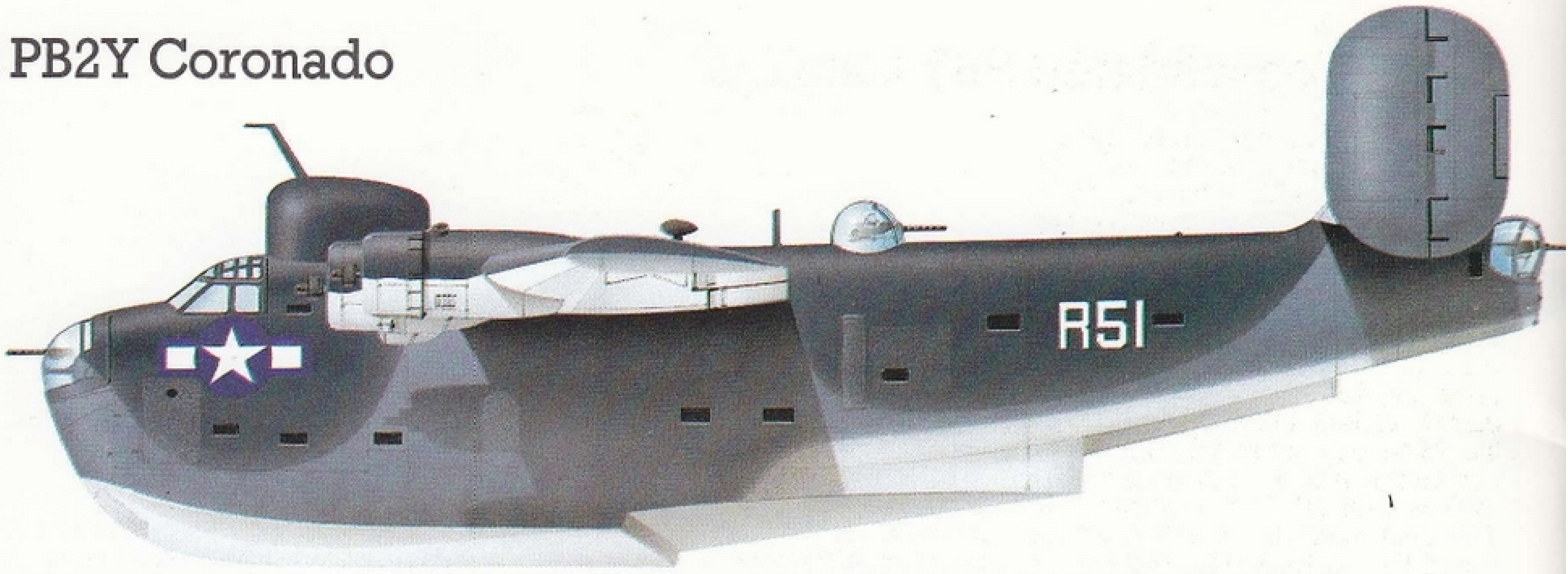
Above: The same aircraft as featured in the previous picture loses height rapidly, its starboard wing ablaze. The relatively slow speed of the 'Emily' rendered it easy prey for marauding Allied fighters.

An RAF Catalina flies along the shores of Ceylon. Catalinas served with Nos 191, 205, 209, 212, 240, 259, 262, 265, 321, 357, and 628 Sqns in India and East Africa for patrol duties over the Bay of Bengal and the Indian Ocean.

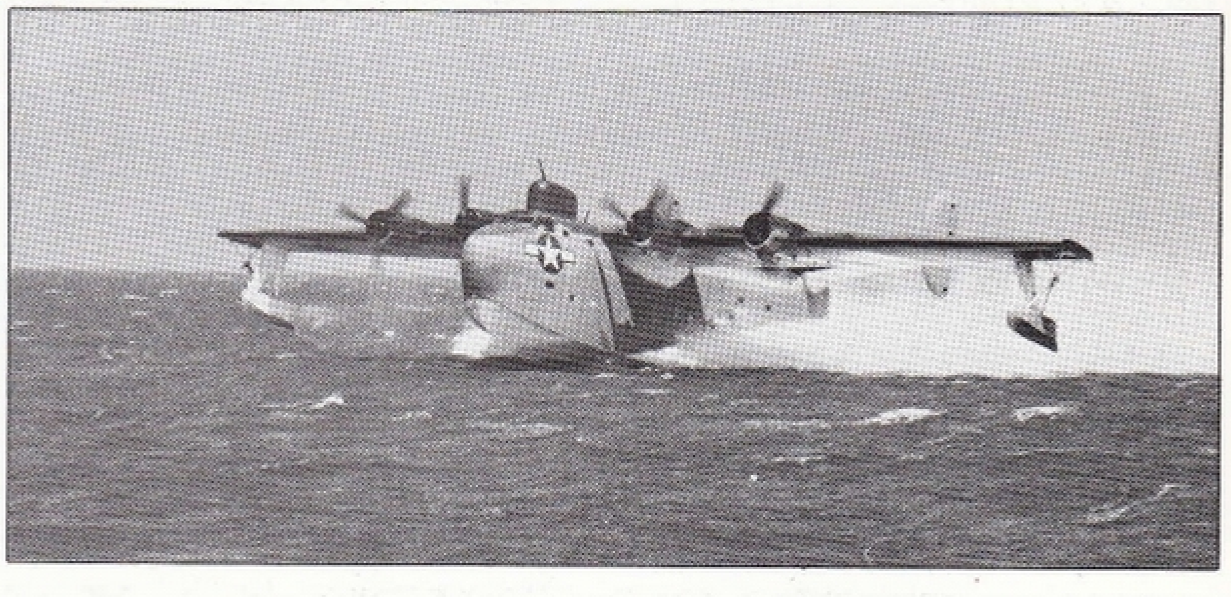
USA

Consolidated PB2Y Coronado

While pursuing a course of isolationism the United States had recognized during the mid-1930s the spectre of world war, the possibility of such a war being waged on the oceans bordering the North American continent encouraging interest by the US Navy in the evolution of large maritime reconnaissance bombers. On 27 July 1936 the Consolidated Aircraft Corporation was contracted to design and build such an aircraft. Designated **Consolidated XPB2Y-1**, the resulting design was a big four-engine shoulder-wing monoplane with single fin and rudder and retracting wing-tip stabilizing floats. First flown on 17 December 1937, the prototype disclosed serious directional instability in the air and much to be desired in handling on the water, and in due course the tail unit was redesigned to incorporate a pair of circular endplate fins and rudders. After trials with the US Navy six production **PB2Y-2** aircraft were ordered and entered service with US Navy Patrol Squadron VP-13 on 31 December 1940. These aircraft, lacking armour and self-sealing fuel tanks, were largely confined to trials but a new version, the **PB2Y-3**, of which 210 were produced, started delivery in 1941 with 907-kg (2,000 lb) of armour plate as well as self-sealing fuel tanks; they also featured enlarged 'zulu shield' fins and rudders that were a characteristic of the Consolidated B-24 Liberator bomber. Ten of these aircraft were transferred to the Royal Air Force whose Transport Command flew them as **Consolidated Coronado Mk I** freighters on a North Atlantic service with No. 231 Squadron. An American transport version was designated **PB2Y-3R**, 31 examples being converted to accommodate up to 45 passengers or a 7258-kg (16,000-lb) freight load. For relatively low altitude work some PB2Y-3s were re-engined with R-1830-92s for oversea patrol work below 3050 m (10,000 ft) under the designation **PB2Y-5**, and an ambulance version which served in the Pacific as the **PB2Y-5R**. Other distinctive features of the PB2Y-3 and PB2Y-5 versions included the rearward extension of the rear hull chine to improve water stability and handling. In the event the Coronado was not widely used in the maritime reconnaissance role as preference grew for use of land-based aircraft such as the Consolidated PB4Y-1 which required no specialist training in water operation, while the excellent Consolidated PBY Catalina remained unequalled for long distance ocean reconnaissance.



The Consolidated PB2Y-3 Coronado entered service late in the war with increased armament, armour and self-sealing fuel tanks; its bomb bays were located in the relatively thick wing roots.



The big Consolidated PB2Y Coronado four-engined flying-boat, seen here with ASV radome above the cockpit, featured retractable wingtip floats like those of its forebear, the Catalina.

Specification

Consolidated PB2Y-3

Type: 10-crew maritime reconnaissance bomber flying-boat
Powerplant: four 1,200-hp (895-kW) Pratt & Whitney R-1830-88 Twin Wasp 14-cylinder air-cooled radials
Performance: maximum speed 359 km/h (223 mph) at 6095 m (20,000 ft); initial climb rate 174 m (570 ft) per minute; service ceiling 6250 m (20,500 ft); maximum range 3815 km (2,370 miles)
Weights: empty 18568 kg (40,935 lb); maximum take-off 30845 kg (68,000 lb)
Dimensions: span 35.05 m (115 ft 0 in); length 24.20 m (79 ft 3 in); height 8.38 m (27 ft 6 in); wing area 175.4 m^2 (1,780 sq ft)
Armament: twin 12.7-mm (0.5-in) machine-guns each in bow, dorsal and tail turrets, and two 12.7-mm (0.5-in) guns in beam hatches, plus a bombload of up to eight 454-kg (1,000-lb) bombs internally and four 454-kg (1,000-lb) bombs or two torpedoes externally; transport version furnished to carry up to 45 passengers

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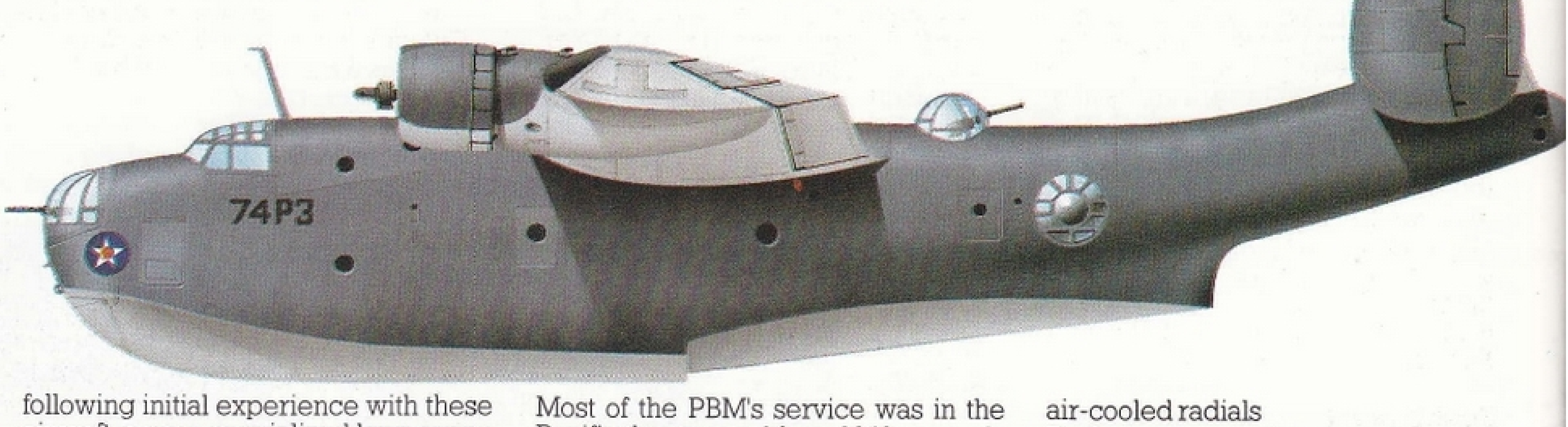
USA

Martin PBM Mariner

Representing a later generation of maritime patrol flying-boats than the PBY Catalina, the Martin PBM Mariner nevertheless never achieved the widespread popularity and use of its predecessor. The aircraft shown here served with US Navy Patrol Squadron VP-74 in 1942.



Stung to competition by the success of the PBY Catalina from Consolidated, the US Navy's other great flying boat manufacturer came up with a twin-engine shoulder-wing monoplane boat, the **Martin Model 162**, in 1937. Featuring a deep hull and twin fins and rudders, the prototype **XPBM-1** was first flown on 18 February 1939 with 1,600-hp (1194-kW) Wright Cyclone R-2600-6 radials mounted at the crank of the gull wing so that the propellers were clear of the spray. Twenty **PBM-1** aircraft had been ordered for the US Navy before the end of 1937 and these entered service with Patrol Squadron VP-74 during 1941. Further orders for 379 **PBM-3 Mariner** aircraft were placed in 1940, these and all later aircraft having the underwing stabilizing floats fixed instead of being retractable as in the earlier aircraft; the engine nacelles were also lengthened to accommodate a 907-kg (2,000-lb) load of ordnance. Variants included 50 unarmed **PBM-3R** transports with accommodation for up to 20 passengers, 274 **PBM-3C** aircraft with standardized American/British equipment and 201 PBM-3D 'boats with R-2600-22 engines, and improved armament and armour. Many of the PBM-3Cs and PBM-3Ds were equipped with ASV search radar in a large fairing over the cockpit and, following initial experience with these aircraft, a new, specialized long-range anti-submarine version, the **PBM-3S**, appeared in 1944; 156 were built. The **PBM-5**, of which 631 were completed, was the last version of the Mariner to be produced during the war, being delivered to the US Navy from August 1944 onwards; this featured an armament of eight 12.7-mm (0.5-in) machine-guns and AN/APS-15 search radar. Five examples of the PBM-3B were delivered to the RAF under Lend-Lease and were flown as **Marine GR.Mk I** aircraft for a short period at the end of 1943 by No. 524 Squadron of Coastal Command at Oban, this squadron being formed to evaluate the aircraft in service, but it was not adopted. Most of the PBM's service was in the Pacific theatre, and from 1943 onwards was widely deployed, being constantly engaged in searching for and shadowing elements of the declining Japanese navy, although many came to be used on air-sea rescue duties as long-range land-based aircraft gradually assumed a greater share of the maritime reconnaissance role.

Specification

Martin PBM-3D

Type: seven/nine-crew maritime reconnaissance flying-boat
Powerplant: two 1,900-hp (1417-kW) Wright R-2600-22 Cyclone 14-cylinder air-cooled radials
Performance: maximum speed 340 km/h (211 mph) at 4875 m (16,000 ft); climb to 3050 m (10,000 ft) in 22 minutes 12 seconds; service ceiling 6035 m (19,800 ft); range 3605 km (2,240 miles)
Weights: empty 15048 kg (33,175 lb); maximum take-off 26309 kg (58,000 lb)
Dimensions: span 35.97 m (118 ft 0 in); length 24.33 m (79 ft 10 in); height 8.38 m (27 ft 6 in); wing area 130.80 m^2 (1,408 sq ft)
Armament: twin 12.7-mm (0.5-in) machine-guns each in bow, dorsal and tail turrets, and one 12.7-mm (0.5-in) machine-gun in each of two beam hatches, plus a bombload of up to 3629 kg (8,000 lb)

USA

Consolidated PBY Catalina

Outstanding among parasol monoplane flying-boats, Isaac Laddon's **Consolidated PBY** was originally ordered by the US Navy as far back as October 1933, and was first flown with a pair of 825-hp (615-kW) Pratt & Whitney R-1830-58 radials on 28 March 1935. Among its distinctive features were the stabilizing floats which, when retracted, formed the wing tips. Production orders followed quickly and the **PBY-1** entered service with more powerful R-1830-64 engines with Patrol Squadron VP-11F in October 1936. The next year the modified **PBY-2** joined the US Navy, followed by the **PBY-3** with 1,000-hp (746-kW) engines. The **PBY-4**, which appeared in 1938, featured the large midships 'blister' gun positions that were to become a well-known characteristic of the **Catalina**, as the boat came to be named. The outbreak of World War II brought orders from the UK, Australia, Canada and the Dutch East Indies for a new version, the **PBY-5** with 1,200-hp (895-kW) R-1830-92 radials, and by the date of the USA's entry into the war the US Navy possessed 16 PBY-5 squadrons, three of PBY-3s and two of PBY-4s. Following tests with a retractable tricycle wheel landing gear in last PBY-4, the final 33 US Navy PBY-5s were completed in this amphibian form, as were 761 **PBY-5A** aircraft. Following early successful use of the PBY-5 by the RAF's Coastal Command in 1941 as the **Catalina Mk I**, large orders continued to be placed for the US Navy, additional production being undertaken by Canadian Vickers and Boeing of Canada. A total of more than 500 examples eventually served with the RAF alone, while in Canadian service the PBY-5 was named the **Canso**. Another version, the **PBN-1**, was produced by the Naval Aircraft Factory with taller fin and rudder, and 138 of the 156 built were supplied to the USSR; 235 **PBY-6A** amphibians with search radar mounted over the cockpit were built, of which 112 were delivered to the US Navy, 75 to the USAAF (as the **OA-10B**) and 48 to the USSR. Production of this classic aeroplane, which ended in April 1945, included 2,398 by Consolidated and 892 by NAF and the Canadian manufacturers, plus an unknown number built in the Soviet Union under the designation **GST**. Among the Catalina's memorable achievements were the successful shadowing of the German battleship *Bismarck* which led ultimately to the warship's destruction, and the magnificent trailing of the Japanese fleets in the early stages of so many of the great naval battles in the Pacific.

Specification

Consolidated PBY-5A

Type: seven/nine-crew maritime reconnaissance flying-boat amphibian

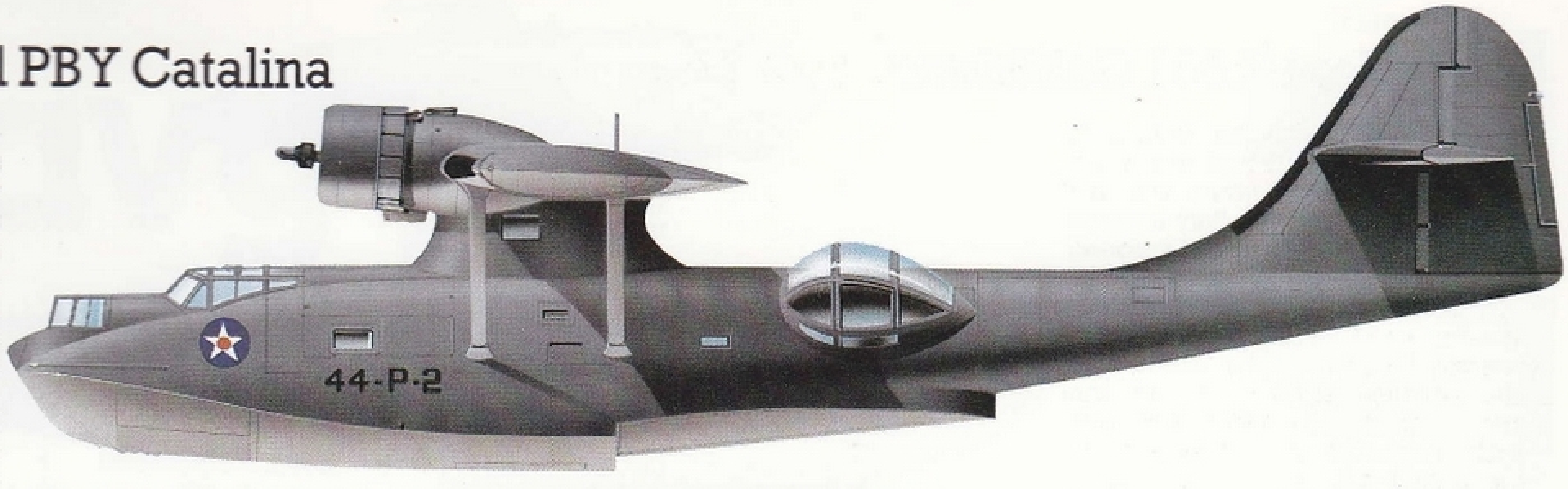
Powerplant: two 1,200-hp (895-kW) Pratt & Whitney R-1830-92 Twin Wasp 14-cylinder air-cooled radials

Performance: maximum speed 288 km/h (179 mph) at 2135 m (7,000 ft); climb to 3050 m (10,000 ft) in 19 minutes 18 seconds; service ceiling 4480 m (14,700 ft); maximum range 4095 km (2,545 miles)

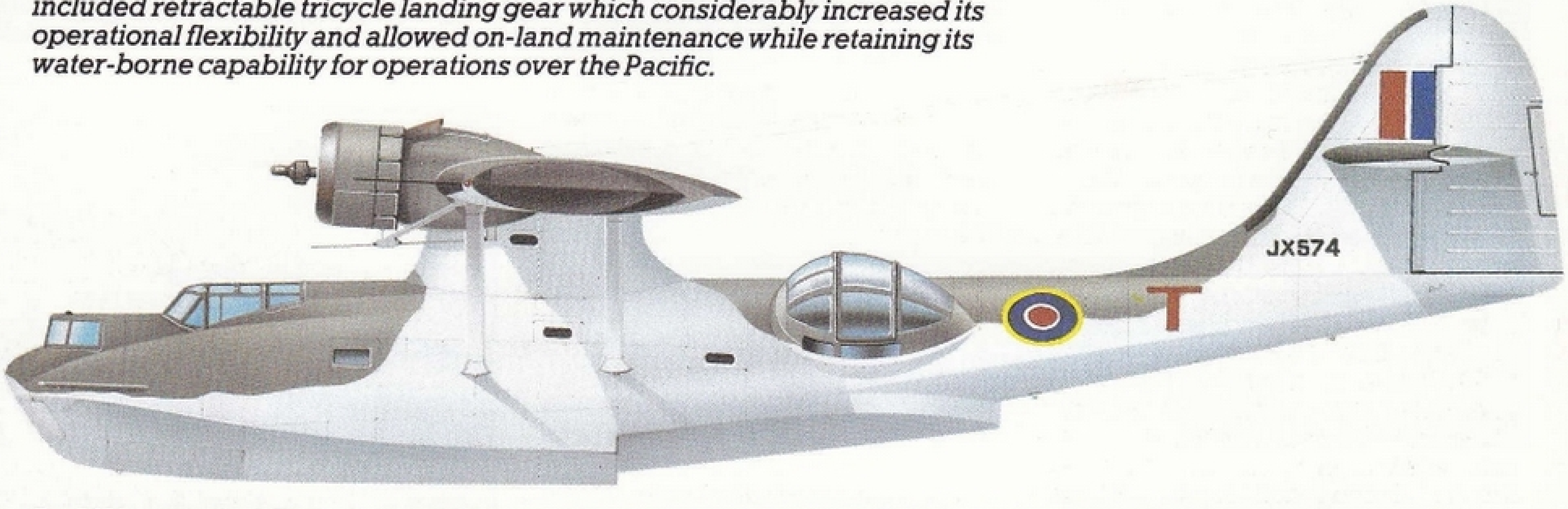
Weights: empty 9485 kg (20,910 lb); maximum take-off 16067 kg (35,420 lb)

Dimensions: span 31.70 m (104 ft 0 in); length 19.45 m (63 ft 10½ in); height 6.15 m (20 ft 2 in); wing area 130.06 m^2 (1,400 sq ft)

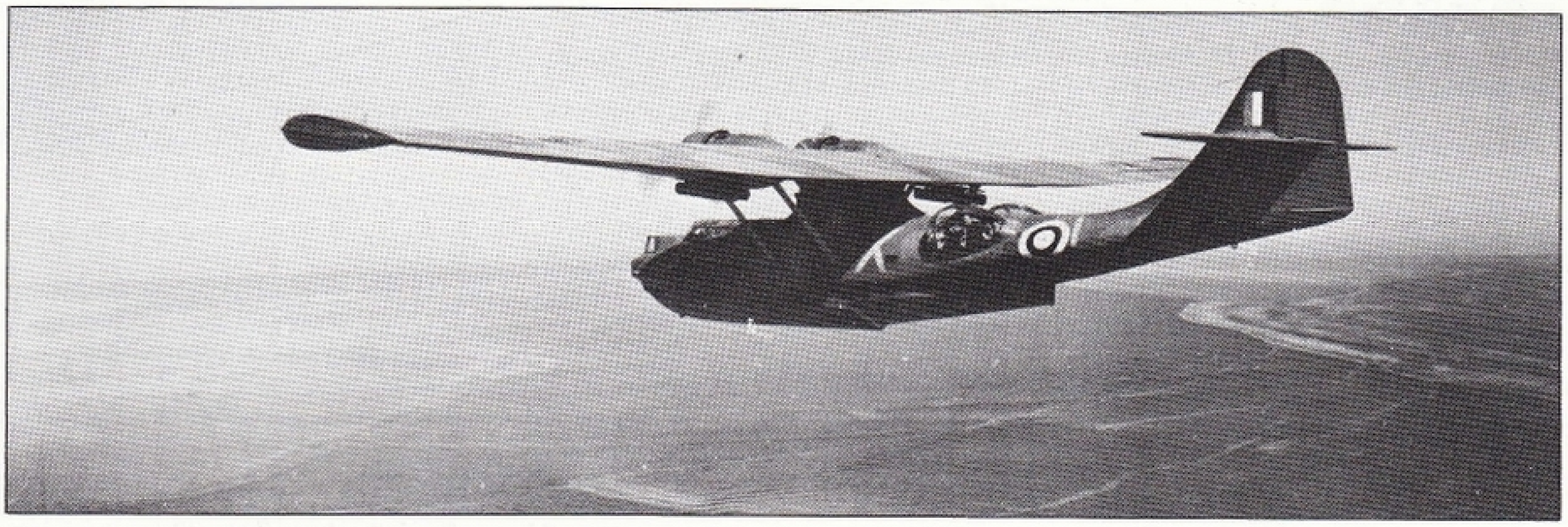
Armament: two 12.7-mm (0.5-in) machine-guns in bow turret, one 12.7-mm (0.5-in) gun in each beam blister, and one 7.62-mm (0.3-in) machine-gun in ventral tunnel, plus a bombload of up to 1814 kg (4,000 lb) of bombs, mines or depth charges, or two torpedoes



Shown here in US Navy colours and markings, the Consolidated PBY-5 included retractable tricycle landing gear which considerably increased its operational flexibility and allowed on-land maintenance while retaining its water-borne capability for operations over the Pacific.

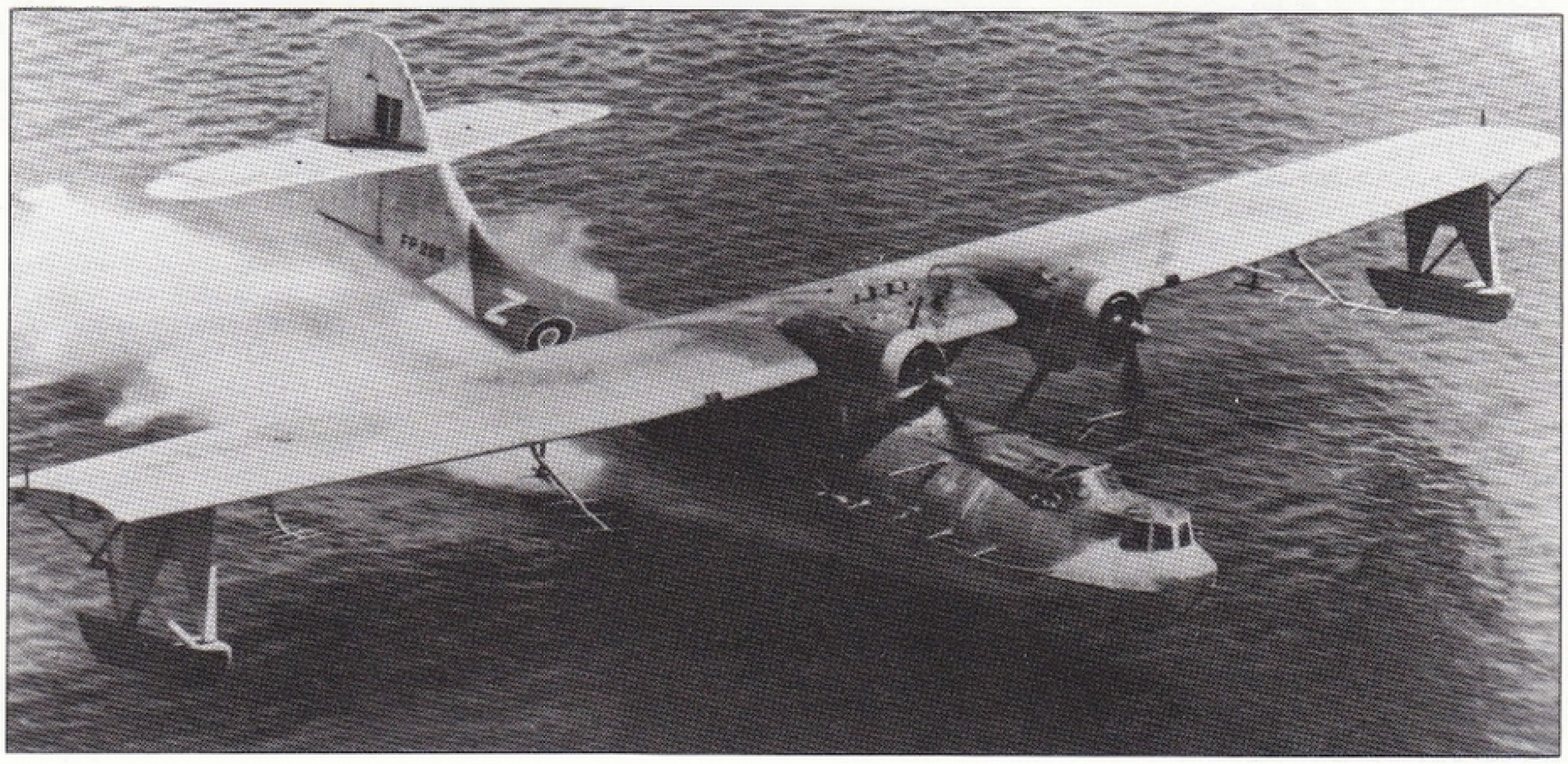


An ASV-equipped Consolidated Catalina IVA (PBY-5A) of RAF Coastal Command. Although generally regarded as under-powered, the 'Cat' gave magnificent service with the RAF, its very long endurance bestowing a capability to cover huge areas of ocean.



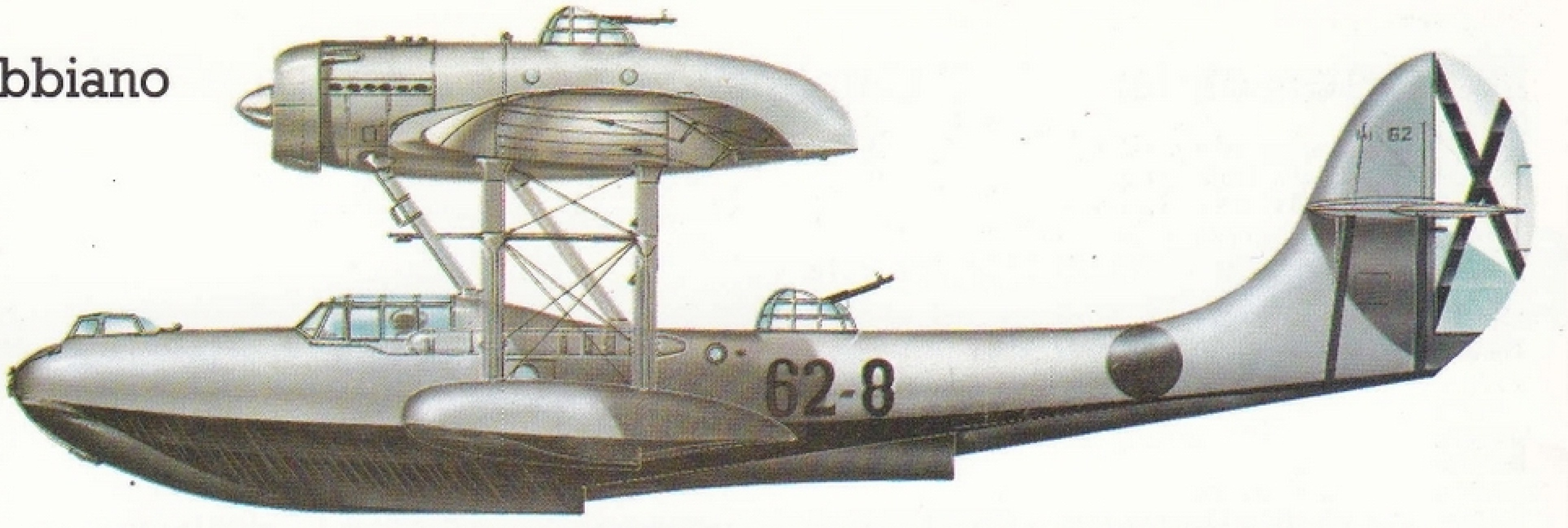
Above: An early Catalina of an RAF Coastal Command training unit. The Catalina is armed with four depth charges for an operational sortie.

Below: Catalina Mk IB (PBY-5B) in RAF service. The extensive radar aerial arrays on fuselage and wings were fitted by Scottish Aviation or Saunders Roe after delivery from the American factory. Note the retractable wingtip floats.



ITALY

Cant Z.501 Gabbiano

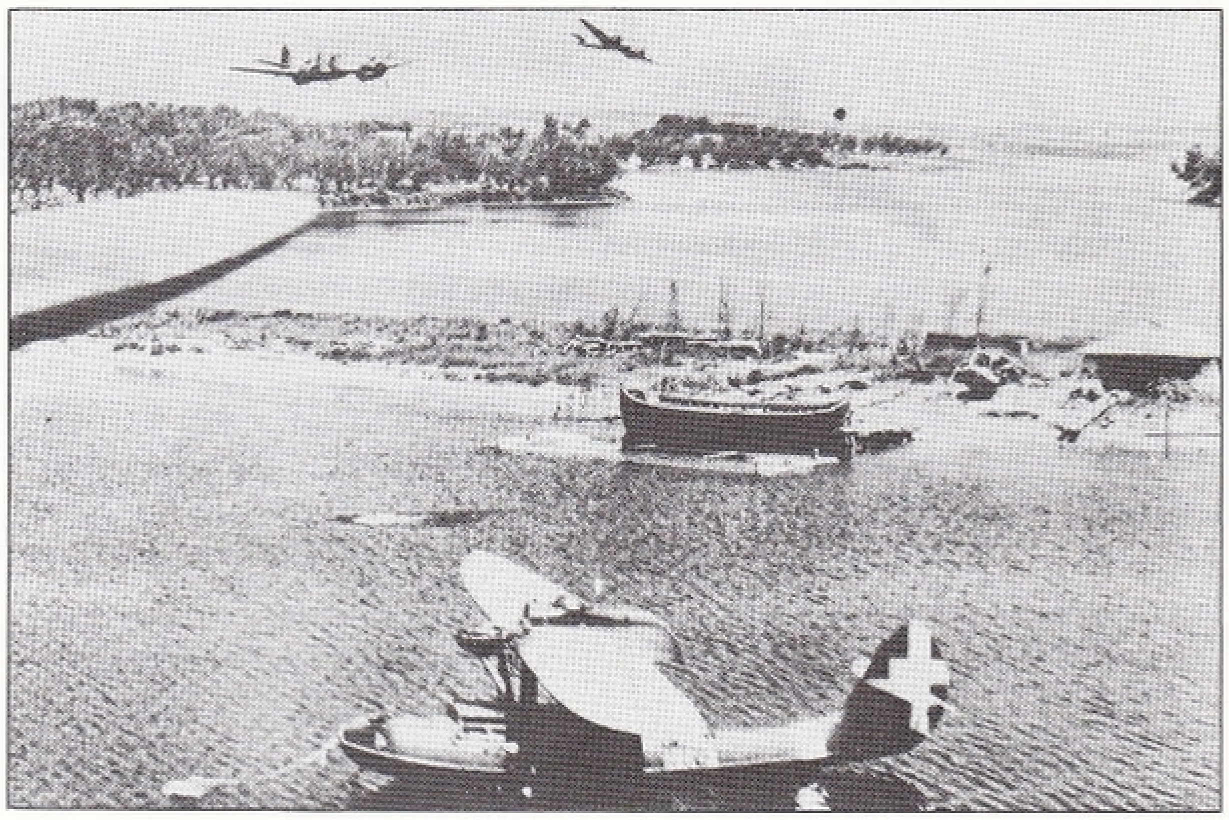


Despite its archaic appearance, the Cant Z.501 Gabbiano gave long service in the Mediterranean, the example shown here serving with the 2° Escuadrilla, Grupo No. 62, Agrupacion Espagnola (the Spanish Nationalist Air Force) at Majorca in 1939.

The **Cant Z.501 Gabbiano** (gull) light reconnaissance flying-boat was serving in fairly large numbers with the Regia Aeronautica when Italy entered World War II in June 1940. Designed by Filippo Zappata in the early 1930s, the prototype was first flown in 1934 at Monfalcone, Trieste, and later in that year established a new world seaplane distance record of 4120 km (2,560 miles) with a nonstop flight from Monfalcone to Massawa in Eritrea. In July the following year the Gabbiano raised the record to 4957 km (3,080 miles) by flying from Monfalcone to Berbera in Somaliland.

The Z.501 entered production in 1935 and the first deliveries were made to the maritime reconnaissance squadrons (*squadriglie da ricognizione marittima*) of the Regia Aeronautica the following year. Of all-wood construction with fabric-covered control surfaces, the Z.501 was a parasol monoplane with its single Isotta Fraschini 12-cylinder liquid-cooled inline engine with semi-annular cowling in a long nacelle on the wing above the fuselage. A curious feature was the location of an enclosed gun position with single 7.7-mm (0.303-in) Breda-SAFAT machine-gun in this nacelle; early production aircraft were also armed with single machine-guns in part-enclosed bow and midships positions; later aircraft had the bow gun removed and the observer's cockpit in the bows fully enclosed. Bomb shackles were fitted at the intersection of the wing and float struts and these were capable of carrying up to four 160-kg (353-lb) or two 250-kg (551-lb) bombs. The planing bottom of the hull was also of unusual design being of concave section.

In June 1940 202 Cant Z.501s were in service with the Regia Aeronautica, flying patrols along the Adriatic coasts as well as in the central Mediterranean, where they performed air-sea rescue and other short-range maritime duties. More than 40 known instances are on record of encounters with Allied aircraft and many were shot down, although they were also involved in the rescue of several ditched RAF aircrews. After the armistice with Italy in September 1943 19 Cant Z.501s continued to serve in the Italian Co-Belligerent Air Force, while others went on flying with the Aviazione della RSI.



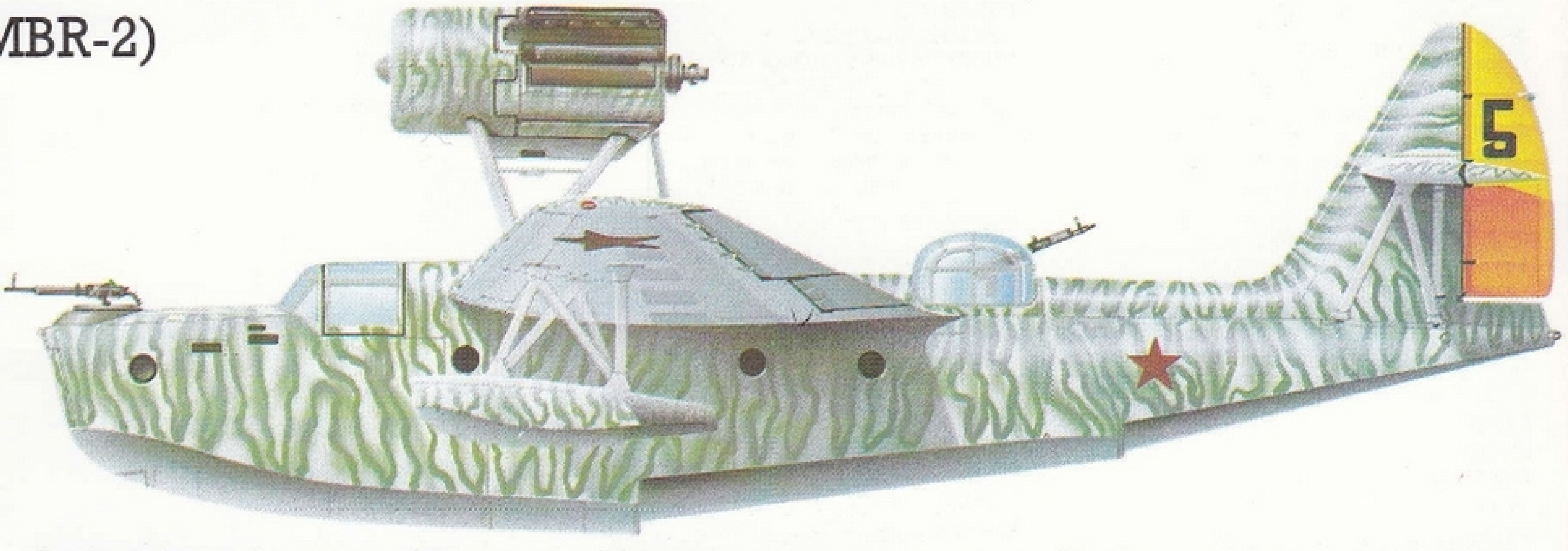
A Cant Z.501 flying-boat at its moorings at Preveza on the West Coast of Greece, during a low level attack by two RAF Beaufighters. The Z.501 was a useful maritime reconnaissance tool, not least because of its long range.

Specification
Cant Z.501 Gabbiano

Type: four/five-crew light reconnaissance flying-boat
Powerplant: one 900-hp (671-kW) Isotta Fraschini Asso XI R2C.15 12-cylinder liquid-cooled inline engine
Performance: maximum speed 275 km/h 171 mph at 2500 m (8,200 ft); climb to 4000 m (13,125 ft) in 16 minutes; service ceiling 7000 m (22,965 ft); maximum range 2400 km (1,490 miles)
Weights: empty 3850 kg (8,488 lb); maximum take-off 7050 kg (15,342 lb)
Dimensions: span 22.50 m (73 ft 9¾ in); length 14.30 m (46 ft 11 in); height 4.40 m (14 ft 6 in); wing area 62.00 m^2 (667.36 sq ft)
Armament: single 7.7-mm (0.303-in) machine-gun each in of bow, engine nacelle and dorsal positions, plus a bombload of up to 640 kg (1,411 lb)

USSR

Beriev Be-2 (MBR-2)



The Beriev MBR-2 was a short range flying-boat and had its inline engine mounted above the wings, driving a pusher propellor. This Soviet navy example carries an unusual winter camouflage scheme.

Never seriously countenancing the possibility of being involved in all-out maritime warfare with a major nation, the Soviet Union accorded low priority to military flying-boats in the 1930s within an air force which in most respects lagged behind other nations in modern technology. Only the designs of G.M. Beriev had attracted any significant attention and these, together with his later designs, constituted almost the only flying-boats flown by the VVS-VMF during World War II.

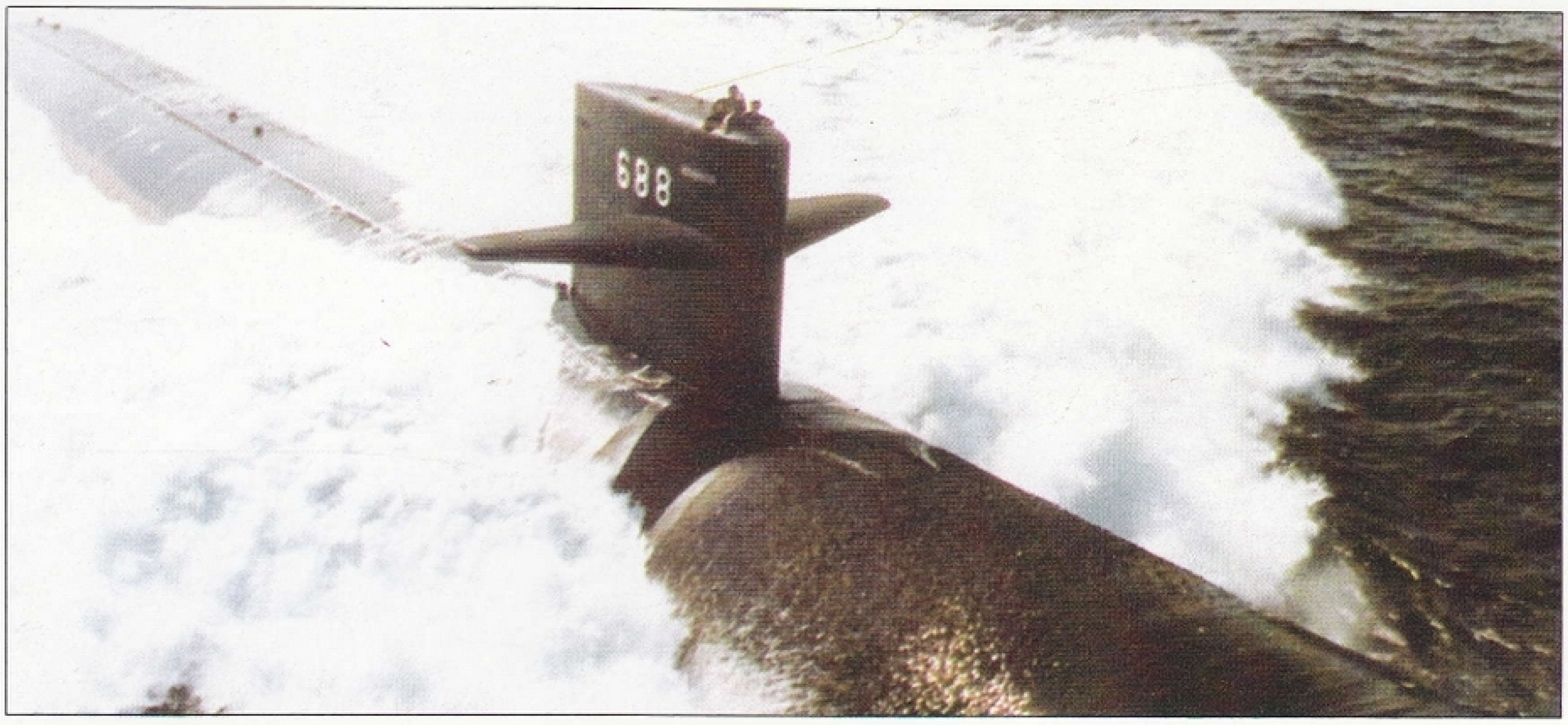
The **MBR-2** (later redesignated **Beriev Be-2**) was first flown back in 1931 and was then considered to be modern by the current international standards. It was a small single-engine monoplane with wooden hull and strictly tailored to the needs of coastal units in the Baltic and Black Seas, though it could also be operated with skis or wheel landing gear. The outbreak of World War II triggered hurried efforts to develop a new version, the **MBR-2bis**, which was powered by an 860-hp (642-kW) AM-34 engine in place of the earlier 680-hp (507-kW) M-17 engine; increased fuel tankage raised the range from 960 km (597 miles) to 1400 km (870 miles); for the purposes of maritime reconnaissance over the confined waters of the Baltic and Black Seas, as well as the northern Arctic seaboard, the new version was seen as an ideal interim aircraft pending the arrival in service of substantial numbers of the MDR-6 (Be-4), and in 1942 about 1,500 aircraft were delivered to the VVS-VMF. Being thus the most widely-used Soviet short-range 'boat in the first three years of the war one of its principal tasks was the sea rescue of downed airmen although, with only token defensive armament and no performance worth mention, the MBR-2 fell easy prey to the massively superior aircraft of the Luftwaffe during that period. Away from such depredations another version, designated the **MP-1**, was employed as a transport with accommodation for up to eight passengers; a pre-war commercial example had established a number of world altitude records for women pilots, and one of these records remained intact for more than 20 years.

Specification
MBR-2bis

Type: four/five-crew short-range reconnaissance flying-boat
Powerplant: one 860-hp (642-kW) AM-34NB 12-cylinder liquid-cooled inline engine
Performance: maximum speed 248 km/h (154 mph) at 2000 m (6,560 ft); service ceiling 6000 m (19,685 ft); maximum range 1400 km (870 miles)
Weight: maximum take-off 4245 kg (9,359 lb)
Dimensions: span 19.00 m (62 ft 4 in); length 13.50 m (44 ft 3¾ in); wing area 55.00 m^2 (592 sq ft)
Armament: one hand-held 7.62-mm (0.3-in) machine-gun in open bow position and one 7.62-mm (0.3-in) gun in midships dorsal turret, plus up to 300 kg (661 lb) of bombs, mines or depth charges on underwing racks

US Navy

Part 6



A dramatic picture of USS Los Angeles *(SSN 688) at maximum surface speed. Modern submarines, optimized for underwater travel, are much faster when submerged.*

US Navy fleet list (continued)

'BROOOKE' CLASS
FFG 1 *Brooke* (San Diego, Ca)
FFG 2 *Ramsey* (Long Beach, Ca)
FFG 3 *Schofield* (San Diego, Ca)
FFG 4 *Talbot* (Mayport, Fl)
FFG 5 *Richard L. Page* (Norfolk, Va)
FFG 6 *Julius A. Furer* (Charleston, SC)

'OLIVER HAZARD PERRY' CLASS
FFG 7 *Oliver Hazard Perry* (Mayport, Fl)
FFG 8 *McInerney* (Mayport, Fl)
FFG 9 *Wadsworth* (Long Beach, Ca)
FFG 11 *Clark* (Mayport, Fl)
FFG 12 *George Philip* (San Diego, Ca)
FFG 13 *Samuel Eliot Morison* (Mayport, Fl)
FFG 14 *Sides* (San Diego, Ca)
FFG 15 *Estocin* (Mayport, Fl)
FFG 16 *Clifton Sprague* (Mayport, Fl)
FFG 19 *John A. Moore* (San Diego, Ca)
FFG 20 *Antrim* (Mayport, Fl)
FFG 21 *Flatley* (Mayport, Fl)
FFG 22 *Fahrion* (Mayport, Fl)
FFG 23 *Lewis B. Puller* (San Diego, Ca)
FFG 24 *Jack Williams* (Mayport, Fl)
FFG 25 *Copeland* (Long Beach, Ca)
FFG 26 *Gallery* (Mayport, Fl)
FFG 27 *Mahlon S. Tisdale* (San Diego, Ca)
FFG 28 *Boone* (Mayport, Fl)
FFG 29 *Stephen W. Groves* (Mayport, Fl)
FFG 30 *Reid* (Long Beach, Ca)
FFG 31 *Stark* (Mayport, Fl)
FFG 32 *John L. Hall* (Mayport, Fl)
FFG 33 *Jarrett* (Long Beach, Ca)
FFG 34 *Aubrey Fitch* (Mayport, Fl)
FFG 36 *Underwood* (Mayport, Fl)
FFG 37 *Crommelin* (Long Beach, Ca)
FFG 38 *Curts* (Long Beach, Ca)
FFG 39 *Doyle* (Mayport, Fl)
FFG 40 *Halyburton* (Charleston, SC)
FFG 41 *Mc Clusky* (Long Beach, Ca)
FFG 42 *Klakring* (Charleston, SC)
FFG 45 *Dewert* (Charleston, SC)

SUBMARINES

ATTACK SUBMARINES

'DARTER' CLASS
SS 576 *Darter* (Sasebo, Japan)

'BARBEL' CLASS
SS 580 *Barbel* (Pearl Harbor, HI)
SS 581 *Blueback* (San Diego, Ca)
SS 582 *Bonefish* (Charleston, SC)

'SEAWOLF' CLASS
SSN 575 *Seawolf* (Vallejo, Ca)

'SKATE' CLASS
SSN 578 *Skate* (Pearl Harbor, HI)
SSN 579 *Swordfish* (Pearl Harbor, HI)
SSN 583 *Sargo* (Pearl Harbor, HI)
SSN 584 *Seadragon* (Pearl Harbor, HI)

'SKIPJACK' CLASS
SSN 585 *Skipjack* (Groton, Ct)
SSN 588 *Scamp* (Groton, Ct)
SSN 590 *Sculpin* (Groton, Ct)
SSN 591 *Shark* (Groton, Ct)
SSN 592 *Snook* (Groton, Ct)

'PERMIT' CLASS
SSN 594 *Permit* (Vallejo, Ca)
SSN 595 *Plunger* (San Diego, Ca)
SSN 596 *Barb* (San Diego, Ca)
SSN 603 *Pollack* (San Diego, Ca)
SSN 604 *Haddo* (San Diego, Ca)
SSN 605 *Jack* (Portsmouth, NH)
SSN 606 *Tinosa* (Portsmouth, NH)
SSN 607 *Dace* (New London, Ct)
SSN 612 *Guardfish* (Vallejo, Ca)
SSN 613 *Flasher* (Vallejo, Ca)
SSN 614 *Greenling* (New London, Ct)
SSN 615 *Gato* (New London, Ct)
SSN 621 *Haddock* (San Diego, Ca)

'TULLIBEE' CLASS
SSN 597 *Tullibee* (Groton, Ct)

'GEORGE WASHINGTON' CLASS
SSN 598 *George Washington* (New London, Ct)
SSN 599 *Patrick Henry* (Bangor, Wa)

'ETHAN ALLEN' CLASS
SSN 609 *Sam Houston* (Bangor, Wa)
SSN 611 *John Marshall* (Bremerton, Wa)
SSN 618 *Thomas Jefferson* (Charleston, SC)

'STURGEON' CLASS
SSN 637 *Sturgeon* (Charleston, SC)
SSN 638 *Whale* (Groton, Ct)
SSN 639 *Tautog* (Pearl Harbor, HI)
SSN 646 *Grayling* (Charleston, SC)
SSN 647 *Pogy* (Vallejo, Ca)
SSN 648 *Aspro* (Pearl Harbour, HI)
SSN 649 *Sunfish* (Charleston, SC)
SSN 650 *Pargo* (New London, Ct)
SSN 651 *Queenfish* (Pearl Harbor, HI)
SSN 652 *Puffer* (Pearl Harbor, HI)
SSN 653 *Ray* (Charleston, SC)
SSN 660 *Sand Lance* (Charleston, SC)
SSN 661 *Lapon* (Norfolk, Va)
SSN 662 *Gurnard* (San Diego, Ca)
SSN 663 *Hammerhead* (Norfolk, Va)
SSN 664 *Sea Devil* (Charleston, SC)
SSN 665 *Guitarro* (San Diego, Ca)
SSN 666 *Hawkbill* (Pearl Harbor, HI)
SSN 667 *Bergall* (Norfolk, Va)
SSN 668 *Spadefish* (Norfolk, Va)
SSN 669 *Seahorse* (Charleston, SC)
SSN 670 *Finback* (Norfolk, Va)
SSN 672 *Pintado* (San Diego, Ca)
SSN 673 *Flying Fish* (Norfolk, Va)
SSN 674 *Trepang* (New London, Ct)
SSN 675 *Bluefish* (Norfolk, Va)
SSN 676 *Billfish* (New London, Ct)
SSN 677 *Drum* (San Diego, Ca)
SSN 678 *Archerfish* (Portsmouth, NH)
SSN 679 *Silversides* (Norfolk, Va)
SSN 680 *William H. Bates* (San Diego, Ca)
SSN 681 *Batfish* (Charleston, SC)
SSN 682 *Tunny* (Pearl Harbor, HI)
SSN 683 *Parche* (Vallejo, Ca)
SSN 684 *Cavalla* (Pearl Harbor, HI)
SSN 686 *L. Mendel Rivers* (Charleston, SC)
SSN 687 *Richard B. Russell* (Vallejo, Ca)

'NARWHAL' CLASS
SSN 671 *Narwhal* (Charleston, SC)

'GLENARD P. LIPSCOMB' CLASS
SSN 685 *Glenard P. Lipscomb* (Norfolk, Va)

'LOS ANGELES' CLASS
SSN 688 *Los Angeles* (Pearl Harbor, HI)
SSN 689 *Baton Rouge* (Norfolk, Va)
SSN 690 *Philadelphia* (Groton, Ct)
SSN 691 *Memphis* (Norfolk, Va)
SSN 692 *Omaha* (Pearl Harbor, HI)
SSN 693 *Cincinnati* (Norfolk, Va)
SSN 694 *Groton* (Groton, Ct)
SSN 695 *Birmingham* (Norfolk, Va)
SSN 696 *New York City* (Pearl Harbor, HI)
SSN 697 *Indianapolis* (Pearl Harbor, HI)
SSN 698 *Bremerton* (Pearl Harbor, HI)
SSN 699 *Jacksonville* (Norfolk, Va)
SSN 700 *Dallas* (Groton, Ct)
SSN 701 *La Jolla* (San Diego, Ca)
SSN 702 *Phoenix* (Norfolk, Va)
SSN 703 *Boston* (Groton, Ct)
SSN 704 *Baltimore* (Norfolk, Va)
SSN 705 *City of Corpus Christi* (Groton, Ct)
SSN 706 *Albuquerque* (Groton, Ct)
SSN 707 *Portsmouth* (Groton, Ct)
SSN 711 *San Francisco* (Pearl Harbor, HI)
SSN 712 *Atlanta* (Norfolk, Va)
SSN 713 *Houston* (San Diego, Ca)
SSN 714 *Norfolk* (Norfolk, Va)
SSN 715 *Buffalo* (Norfolk, Va)

PATROL COMBATANTS

PATROL SHIPS

'PEGASUS' CLASS
PHM 1 *Pegasus* (Key West, Fl)
PHM 2 *Hercules* (Key West, Fl)
PHM 3 *Taurus* (Key West, Fl)
PHM 4 *Aquila* (Key West, Fl)
PHM 5 *Aries* (Key West, Fl)
PHM 6 *Gemini* (Key West, Fl)

AMPHIBIOUS WARFARE SHIPS

AMPHIBIOUS HELO/LANDING CRAFT CARRIERS

'TARAWA' CLASS
LHA 1 *Tarawa* (San Diego, Ca)
LHA 2 *Saipan* (Norfolk, Va)
LHA 3 *Belleau Wood* (San Diego, Ca)
LHA 4 *Nassau* (Norfolk, Va)
LHA 5 *Peleliu* (Long Beach, Ca)

'RALEIGH' CLASS
LPD 1 *Raleigh* (Norfolk, Va)
LPD 2 *Vancouver* (San Diego, Ca)

'AUSTIN' CLASS
LPD 4 *Austin* (Norfolk, Va)
LPD 5 *Ogdon* (Long Beach, Ca)
LPD 6 *Duluth* (San Diego, Ca)
LPD 7 *Cleveland* (San Diego, Ca)
LPD 8 *Dubuque* (San Diego, Ca)
LPD 9 *Denver* (San Diego, Ca)
LPD 10 *Juneau* (San Diego, Ca)
LPD 12 *Shreveport* (Norfolk, Va)
LPD 13 *Nashville* (Norfolk, Va)
LPD 14 *Trenton* (Norfolk, Va)
LPD 15 *Ponce* (Norfolk, Va)

'IWO JIMA' CLASS
LPH 2 *Iwo Jima* (Norfolk, Va)
LPH 3 *Okinawa* (San Diego, Ca)
LPH 7 *Guadalcanal* (Norfolk, Va)
LPH 9 *Guam* (Norfolk, Va)
LPH 10 *Tripoli* (San Diego, Ca)
LPH 11 *New Orleans* (San Diego, Ca)

LANDING CRAFT CARRIERS

'CHARLESTON' CLASS
LKA 113 *Charleston* (Norfolk, Va)
LKA 114 *Durham* (San Diego, Ca)
LKA 115 *Mobile* (Long Beach, Ca)
LKA 116 *Saint Louis* (Sasebo, Japan)
LKA 117 *El Paso* (Norfolk, Va)

'THOMASTON' CLASS
LSD 28 *Thomaston* (San Diego, Ca)
LSD 30 *Fort Snelling* (Little Creek, Norfolk, Va)
LSD 32 *Spiegel Grove* (Little Creek, Norfolk, Va)
LSD 33 *Alamo* (San Diego, Ca)
LSD 34 *Hermitage* (Little Creek, Norfolk, Va)
LSD 35 *Monticello* (San Diego, Ca)

'ANCHORAGE' CLASS
LSD 36 *Anchorage* (San Diego, Ca)
LSD 37 *Portland* (Little Creek, Norfolk, Va)
LSD 38 *Pensacola* (Little Creek, Norfolk, Va)
LSD 39 *Mount Vernon* (San Diego, Ca)
LSD 40 *Fort Fisher* (San Diego, Ca)

'NEWPORT' CLASS
LST 1179 *Newport* (Little Creek, Norfolk, Va)
LST 1180 *Manitowoc* (Little Creek, Norfolk, Va)
LST 1181 *Sumter* (Little Creek, Norfolk, Va)
LST 1182 *Fresno* (San Diego, Ca)
LST 1183 *Peoria* (San Diego, Ca)
LST 1184 *Frederick* (San Diego, Ca)
LST 1185 *Schenectady* (San Diego, Ca)
LST 1186 *Cayuga* (Sand Diego, Ca)
LST 1187 *Tuscaloosa* (San Diego, Ca)
LST 1188 *Saginaw* (Portsmouth, Va)
LST 1189 *San Bernardino* (San Diego, Ca)
LST 1192 *Spartanburg County* (Little Creek, Norfolk, Va)
LST 1193 *Fairfax County* (Little Creek, Norfolk, Va)
LST 1194 *La Moure County* (Little Creek, Norfolk, Va)
LST 1195 *Barbour County* (San Diego, Ca)
LST 1196 *Harlan County* (Little Creek, Norfolk, Va)
LST 1197 *Barnstable County* (Little Creek, Norfolk, Va)
LST 1198 *Bristol County* (San Diego, Ca)

MISCELLANEOUS AMPHIBIOUS WARFARE SHIPS

'BLUE RIDGE' CLASS
LCC 19 *Blue Ridge* (Yokosuka, Japan)
LCC 20 *Mount Whitney* (Norfolk, Va)

MINE WARFARE SHIPS

MINESWEEPERS

'AGGRESSIVE' CLASS
MSO 443 *Fidelity* (Panama City, Fl)
MSO 448 *Illusive* (Charleston, SC)
MSO 490 *Leader* (Charleston, SC)

MOBILE LOGISTIC SHIPS

UNDERWAY REPLENISHMENT SHIPS

'SURIBACHI' CLASS
AE 21 *Suribachi* (Weapon Station Earle, NJ)
AE 22 *Mauna Kea* (Vallejo, Ca)

12 PASS

'NITRO' CLASS
AE 23 *Nitro* (Weapons Station Earle, NJ)
AE 24 *Pyro* (Vallejo, Ca)
AE 24 *Haleakala* (Concord, Ca)

'KILAUEA' CLASS
AE 27 *Butte* (Weapons Station Earle. NJ)
AE 28 *Santa Barbara* (Weapons Station Charleston, SC)
AE 29 *Mount Hood* (Concord, Ca)
AE 32 *Flint* (Concord, Ca)
AE 33 *Shasta* (San Diego, Ca)
AE 34 *Mount Baker* (Weapons Station Charleston, SC)
AE 35 *Kiska* (Concord, Ca)

'MARS' CLASS
AFS 1 *Mars* (Oakland, Ca)
AFS 2 *Sylvania* (Norfolk, Va)
AFS 3 *Niagara Falls* (Guam, HI)
AFS 4 *White Plains* (Yokosuka, Japan)
AFS 5 *Concord* (Norfolk, Va)
AFS 6 *San Diego* (Norfolk, Va)
AFS 7 *San Jose* (Guam, HI)

'JUMBO'/'ASHTABULA' CLASS
AO 98 *Caloosahatchef* (Norfolk, Va)
AO 99 *Camisteo* (Norfolk, Va)

'CIMARRON' CLASS
AO 177 *Cimarron* (Pearl Harbor, HI)
AO 178 *Monogahela* (Norfolk, Va)
AO 179 *Merrimack* (Norfolk, Va)
AO 180 *Willamette* (Pearl Harbor, HI)
AO 186 *Platte* (Norfolk, Va)

'SACRAMENTO' CLASS
AOE 1 *Sacramento* (Bremerton, Wa)
AOE 2 *Camden* (Bremerton, Wa)
AOE 3 *Seattle* (Norfolk, Va)
AOE 4 *Detroit* (Norfolk, Va)

'WICHITA' CLASS
AOR 1 *Wichita* (Alameda, Ca)
AOR 2 *Milwaukee* (Norfolk, Va)
AOR 3 *Kansas City* (Alameda, Ca)
AOR 4 *Savannah* (Norfolk, Va)
AOR 5 *Wabash* (Alameda, Ca)
AOR 6 *Kalamazoo* (Norfolk, Va)
AOR 7 *Roanoke* (Alameda, Ca)

'KILAUEA' CLASS
TAE 26 *Kilauea* (no home port assigned)

'RIGEL' CLASS
TAF 58 *Rigel* (no home port assigned)

'SIRIUS' CLASS
TAFS 8 *Sirius* (no home port assigned)
TAFS 9 *Spica* (Oakland, Ca)
TAFS 10 *Saturn* (no home port assigned)

'JUMBO'/'MISPILLION' CLASS
TAO 105 *Mispillion* (no home port assigned)
TAO 106 *Navasota* (no home port assigned)
TAO 107 *Passumpsic* (no home port assigned)
TAO 108 *Pawcatuck* (no home port assigned)
TAO 109 *Waccamaw* (no home port assigned)

'NEOSHO' CLASS
TAO 143 *Neosho* (no home port assigned)
TAO 144 *Mississinewa* (no home port assigned)
TAO 145 *Hassayampa* (no home port assigned)
TAO 146 *Kawishiwi* (no home port assigned)
TAO 147 *Truckee* (no home port assigned)
TAO 148 *Ponchatoula* (no home port assigned)

SUPPORT FORCES

MOBILE LOGISTIC SHIPS

MATERIAL SUPPORT SHIPS

'DIXIE' CLASS
AD 15 *Prairie* (Long Beach, Ca)
AD 18 *Sierra* (Charleston, SC)
AD 19 *Yosemite* (Mayport, Fl)

'SAMUEL GOMPERS' CLASS
AD 37 *Samuel Gompers* (San Diego, Ca)
AD 38 *Puget Sound* (Gaeta, Italy)

'YELLOWSTONE' CLASS
AD 41 *Yellowstone* (Norfolk, Va)
AD 42 *Acadia* (San Diego, Ca)
AD 43 *Cape Cod* (San Diego, Ca)
AD 44 *Shenandoah* (Norfolk, Va)

'VULCAN' CLASS
AR 5 *Vulcan* (Norfolk, Va)
AR 6 *Ajax* (San Diego, Ca)
AR 7 *Hector* (NSC Oakland, Ca)
AR 8 *Jason* (Pearl Harbor, HI)

'FULTON' CLASS
As 11 *Fulton* (Quincy, Ma)
AS 18 *Orion* (La Maddalena, Italy)

'PROTEUS' CLASS
AS 19 *Proteus* (Guam, HI)

'Newport' class LSTs are the largest vessels capable of landing tanks and heavy equipment over the beach. The unusual ramp arrangement eliminates the need for large bow doors, thus removing any structural weakness and allowing the LST to maintain 20 knots at sea.

'L. Y. SPEAR' CLASS
AS 36 *L. Y. Spear* (Norfolk, Va)
AS 37 *Dixon* (San Diego, Ca)

'EMORY S. LAND' CLASS
AS 39 *Emory S. Land* (Norfolk, Va)
AS 40 *Frank Cable* (Charleston, SC)
AS 41 *McKee* (San Diego, Ca)

SUPPORT SHIPS

FLEET SUPPORT SHIPS

'BOLSTER' CLASS
ARS 39 *Conserver* (Pearl Harbor, HI)
ARS 40 *Hoist* (Little Creek, Norfolk, Va)
ARS 41 *Opportune* (Little Creek, Norfolk, Va)
ARS 42 *Reclaimer* (Pearl Harbor, HI)
ARS 43 *Recovery* (Little Creek, Norfolk, Va)

'CHANTICLEER' CLASS
ASR 9 *Florikan* (San Diego, Ca)
ASR 13 *Kittiwake* (Norfolk, Va)
ASR 14 *Petrel* (Charleston, SC)
ASR 15 *Sunbird* (Groton, Ct)

'PIGEON' CLASS
ASR 21 *Pigeon* (San Diego, Ca)
ASR 22 *Ortolan* (Charleston, SC)

'EDENTON' CLASS
ATS 1 *Edenton* (Little Creek, Norfolk, Va)
ATS 2 *Beaufort* (Pearl Harbor, HI)
ATS 3 *Brunswick* (Pearl Harbor, HI)

'POWHATAN' CLASS
TATF 166 *Powhatan* (no home port assigned)
TATF 167 *Narragansett* (no home port assigned)
TATF 168 *Catawba* (no home port assigned)
TATF 169 *Navajo* (no home port assigned)
TATF 170 *Mohawk* (no home port alssigned)
TATF 171 *Sioux* (no home port assigned)
TATF 172 *Apache* (no home port assigned)

OTHER AUXILIARIES

'FURMAN' CLASS
TAK 280 *Furman* (no home port assigned)

MOBILIZATION FORCES CATEGORY A

SURFACE COMBATANTS

DESTROYERS

'HULL' CLASS
DD 946 *Edson* (Newport, RI)

FRIGATES

'KNOX' CLASS
FF 1054 *Gray* (Long Beach, Ca)
FF 1060 *Lang* (Long Beach, Ca)
FF 1061 *Patterson* (Philadelphia, Pa)
FF 1072 *Blakely* (Charleston, SC)
FF 1091 *Miller* (Newport, RI)
FF 1096 *Valdez* (Newport, RI)

'OLIVER HAZARD PERRY' CLASS
FFG 10 *Duncan* (Long Beach, Ca)

AMPHIBIOUS WARFARE SHIPS

LANDING CRAFT CARRIERS

'NEWPORT' CLASS
LST 1190 *Boulder* (New York, Ny)
LST 1191 *Racine* (Long Beach, Ca)

LOCAL DEFENCE AND MISCELLANEOUS SUPPORT FORCES

AUXILIARIES AND SEALIFT FORCES

SUPPORT SHIPS

OTHER AUXILIARIES

'POINT LOMA' CLASS
AGOS 2 *Point Loma* (San Diego, Ca)

'LA SALLE' CLASS
AGF 3 *La Salle* (Philadelphia, Pa)

'CORONADO' CLASS
AGF 11 *Coronado* (Philadelphia, Pa)

'DOLPHIN' CLASS
AGSS 555 *Dolphin* (San Diego, Ca)

'NORTON SOUND' CLASS
AVM 1 *Norton Sound* (Port Hueneme, Ca)

'LEXINGTON' CLASS
AVT 16 *Lexington* (Pensacola, Fl)

'NEPTUNE' CLASS
TARC 3 *Neptune* (no home port assigned)

'AEOLUS' CLASS
TARC 2 *Aeolus* (no home port assigned)

'ALBERT J. MEYER' CLASS
TARC 6 *Albert J. Myer* (no home port assigned)

'AK-C337D' CLASS
TAK 2035 *Gulf Shipper*

'AK-C346D B-SHIP' CLASS
TAK 2032 *Hay*

'AC-C4-S66A' CLASS
TAK 2043 *Letittia Lykes*

'COLORADO' CLASS
TAK 1003 *American Spitfire* (no home port assigned)
TAK 1008 *American Titan*
TAK 1010 *American Trojan*
TAK 1004 *Austral Lighting* (no home port assigned)
TAK 1005 *Austral Rainbow* (no home port assigned)

'LASH' CLASS
TAK 1015 *George Wythe*

'HEAVY LIFT' CLASS
TAK 2005 *Transcolorado*

'MERCURY' CLASS
TAKR 10 *Mercury* (no home port assigned)
TAKR 11 *Jupiter* (no home port assigned)

'LYRA' CLASS
TAKR 112 *Lyra* (no home port assigned)

'OVERSEAS' CLASS
TAOT 1204 *Overseas Valdez*
TAOT 1207 *Mormac Star*

'SEALIFT PACIFIC' CLASS
TAOT 174 *Sealift Caribbean* (no home port assigned)

'COLUMBIA' CLASS
TAOT 182 *Columbia* (no home port assigned)
TAOT 185 *Susquehanna* (no home port assigned)

MOBILIZATION FORCES CATEGORY B

MINE WARFARE SHIPS

MINESWEEPERS

'AGGRESSIVE' CLASS
MSO 427 *Constant* (San Diego, Ca)
MSO 433 *Engage* (Mayport, Fl)
MSO 437 *Enhance* (Tacoma, Wa)
MSO 438 *Esteem* (Seattle, Wa)
MSO 439 *Excel* (San Francisco, Ca)
MSO 440 *Exploit* (Newport, RI)
MSO 441 *Exultant* (Mayport, Fl)
MSO 442 *Fearless* Charleston, SC
MSO 446 *Fortify* (Little Creek, Norfolk, Va)
MSO 449 *Impervious* (Mayport, Fl)
MSO 455 *Implicit* (Tacoma, Wa)
MSO 456 *Inflict* (Little Creek, Norfolk, Va)
MSO 464 *Pluck* (San Diego, Ca)
MSO 488 *Conquest* (Seattle, Wa)
MSO 489 *Gallant* (San Francisco, Ca)
MSO 492 *Pledge* (Seattle, Wa)

'ACME' CLASS
MSO 509 *Adroit* (Little Creek, Norfolk, Va)
MSO 511 *Affray* (Newport, RI)

SUPPORT SHIPS

FLEET SUPPORT SHIPS

'ESCAPE' CLASS
ARS 8 *Preserver* (Little Creek, Norfolk, Va)

'BOLSTER' CLASS
ARS 38 *Bolster* (Long Beach, Ca)

'ABNAKI' CLASS
ATF 105 *Moctobi* (Long Beach, Ca)
ATF 110 *Guapaw* (Port Hueneme, Ca)

'ACHOMAWI' CLASS
ATF 159 *Paiute* (Mayport, Fl)
ATF 160 *Papago* (Little Creek, Norfolk, Va)